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The Effect of Digital Technology Adoption On Industry 4.0 Readiness and Business Performance of Culinary MSMEs in Bogor Regency

Pengaruh Adopsi teknologi Digital terhadap Kesiapan Industri 4.0 dan Kinerja Bisnis pada UMKM Kuliner di Kabupaten Bogor

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ABSTRACT

MSMEs significantly contribute to employment and economic growth, particularly in Indonesia, and impact the socioeconomic conditions of the lower middle-class community. The Fourth Industrial Revolution has transformed the fundamental managerial aspects of the industry. The aim of this era was to revolutionise industries through digitalisation. Digital technology can help MSMEs adapt swiftly and accelerate through digital transformation. This study investigates the influence of digital technology on the preparedness of MSMEs in Bogor Regency, West Java Province, for Industry 4.0, and on enhancing business performance using the Technology Acceptance Model (TAM). This study employs a quantitative approach with structural equation modelling (SEM) analysis tools for 116 business actors. Readiness indicators are measured using organizational resilience, infrastructure systems, manufacturing systems, data transformation, and digital technology. The findings of this study indicate that the adoption of digital technology by business actors has a minimal and insignificant impact on business performance in MSMEs, but does influence the preparedness of MSMEs to face Industry 4.0. Readiness indicators indirectly affect the use of digital technology and business performance.

***Keywords**: Digital technology, business performance, industry 4.0, readiness indicators.*

ABSTRAK

UMKM secara signifikan berkontribusi terhadap penyerapan tenaga kerja, pertumbuhan ekonomi di Indonesia, dan sangat mempengaruhi sosial-ekonomi dari masyarakat kelompok menengah kebawah. Revolusi Industri 4.0 telah merubah dasar suatu industri dalam setiap aspek manajerial. Tujuan dari era ini adalah untuk merubah industri melalui digitalisasi. Teknologi digital dapat membantu UMKM beradaptasi dan percepatan melalui transformasi digital. Tujuan dari penelitian ini yaitu untuk menginvestigasi pengaruh teknologi digital terhadap kesiapan UMKM di Kabupaten Bogor, Provinsi Jawa Barat dalam menghadapi Industri 4.0 serta meningkatkan kinerja bisnis dengan metode *Technology Acceptance Model* (TAM). Penelitian ini menggunakan pendekatan metode kuantitatif dengan alat analisis menggunakan *Structural Equation Modeling* (SEM) terhadap 116 pelaku usaha. Indikator kesiapan yang dihitung yaitu berdasarkan ketahanan organisasi, sistem infrastruktur, sistem manufaktur, data transformation dan digital teknologi. Temuan penelitian ini menunjukkan bahwa adopsian teknologi digital oleh pelaku usaha mempunyai pengaruh yang sangat kecil dan tidak signifikan terhadap kinerja usaha pada UMKM, namun berpengaruh terhadap kesiapan UMKM dalam menghadapi Industri 4.0. Indikator kesiapan berpengaruh secara tidak langsung terhadap pemanfaatan teknologi digital dan kinerja bisnis.

Kata kunci: Teknologi digital, kinerja bisnis, industri 4.0, indikator kesiapan.

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INTRODUCTION

The Industrial Revolution 4.0, a technological breakthrough, has played an important role in all sectors worldwide at several societal levels (Daud *et al*., 2022). There are fundamental changes in the concepts, planning, and managerial aspects of policies and rules that positively impact organizational performance (Calış Duman & Akdemir, 2021), making it easier for a business to achieve sustainability (Gupta *et al*., 2021). The focal point in Industrial Revolution 4.0 is the integration of complex machines and devices with the help of software and sensor technology to predict, control, and plan businesses and improve social utilization (International Internet Consortium, 2017). Digital technologies such as e-commerce, mobile banking, and e-wallets cater to modern consumer needs (Charoenat & Harvie, 2021). The internet's integration into human life expands possibilities infinitely (Singh *et al*., 2016). The digital economy industry merges computing, information technology, and communication via various devices such as computers, laptops, and mobile phones (Teng *et al*., 2022). These devices interconnect with digital tools such as cloud computing, artificial intelligence, the Internet of Things (IoT), sensors, and software, enabling streamlined data analysis and transforming human activities, including corporate operations (Alahi *et al*., 2023).

One type of business that plays an important role in improving the economies of developing countries is micro-small, and medium-sized enterprises (MSMEs) (Dumitriu *et al*., 2019). MSMEs has a major impact on the economy and contributes to GDP and employment. They can reduce unemployment, overcome poverty, and contribute to economic growth through GDP (Albalushi & Naqshbandi, 2022). Empowering MSMEs is the top ten priority in driving the national goal of 'Making Indonesia 4.0' (Indonesian Ministry of Industry, 2019). There are 85 percent of MSMEs contribute to employment, 44.8 percent to GDP, and approximately 18 percent to national exports (ASEAN, 2020). Indonesia is an ASEAN country with the highest number of MSME. Indonesia has 65.5 million units (United Nations Conference on Trade and Development (UNCTAD) & ASEAN Secretariat, 2022). Bogor region is the top five highest ranked in West Java, based on the number of MSME with approximately 43.138 businesses (Central Statistics Agency, 2023). This makes West Java province has the highest number of MSME by 2022 (Bahagia *et al*., 2022) approximately 1.5 million who have registered businesses on Online Single Submission (OSS) (Anastasya, 2023).

The adoption of digital technology through digital transformation accelerated by the pandemic significantly impacts an organization's human resources, social life, and business activities (Portulans Institute, 2022). The COVID-19 pandemic has shaken the state of the economy across countries towards technology use initiatives and organizational performance (Babeľová *et al*., 2022). The post-pandemic growth of MSMEs has created several challenges for their survival and resilience in the global economy. These challenges include competition for production using machine mechanization, inadequate government support, export regulations (Anshika & Singla, 2022), lack of understanding of financial management (Agarwal *et al*., 2023), and skill challenges in the workforce, such as the introduction and use of computers and knowledge of technological developments for business innovation (Ayodya, 2022).

Digital transformation is critical for sustaining business performance, facilitating changes in operations and production processes with technologies such as IoT and AI (Felsberger & Reiner, 2020; Seebacher, 2013). As technology evolves, MSMEs must effectively leverage it effectively to foster innovation and progress in today's digital era (Bruce *et al*., 2023). Chonsawat and Sopadang (2020) identify five indicators for small

businesses' readiness of the Fourth Industrial Revolution: organizational resilience, infrastructure systems, manufacturing systems, data transformation, and digital technology. These indicators are interrelated and crucial for MSMEs to adapt swiftly to dynamic business environments and enhance their survival and growth.

This study aims to analyze the impact of digital technology adoption through transformation on the performance of MSMEs (Portulans Institute, 2022) and determine the readiness level to face the Industrial Revolution 4.0, particularly culinary MSMEs in Indonesia. Indonesia prioritizes five MSME targets by 2030, one of which is the food production sector, to become an ASEAN FnB powerhouse (Indonesian Ministry of Industry, 2018). One of the food businesses that will never die is the culinary business, because humans really need food as long as they stay alive and active. Marketed products are in the form of main or complementary foods and beverages processed using raw materials into dishes that are ready to enjoy (Sinurat *et al.*, 2021). Tremendous obstacles occurred during digital transformation, which caused a decline in culinary business trends.

The application of Industry 4.0 in each country varies depending on the level of mastery of digital technology (Nasution, 2020) in operations and production management, digital marketing and promotion strategies, the use of applications in financial reporting, human resource data management, and its potential digitally in the development of MSMEs. This provides opportunities to increase regional incomes, impact economic growth, open new jobs, increase GDP, raise living standards, reduce poverty and unemployment rates to achieve high social life goals, and grow the national economy for future sustainability of the MSMEs sector (Selase *et al*., 2019).

LITERATURE RIVIEW

Adoption of Digital Technology

Thanasrivanitchai *et al*. (2021) argue that the use of technology by an individual can be measured using the Technology Acceptance Model (TAM) in the context of Internet use. This method can identify a person's application of a technology through the perception of usability, ease of use, compatibility, and cost efficiency. Thus, digital technology can be easily applied, has an impact on business, can help problems before using technology, and most importantly, in compatibility with business needs, both in terms of usefulness and cost-effectiveness to adopt the technology (Selase *et al.*, 2019). People in MSME play a critical role in applying technology that is influenced by knowledge, desire, and attitude toward change using new technology (Bruce *et al*., 2023).

Readiness Indicator by Chonsawat & Sopadang (2020)

Readiness Indicator denotes MSMEs' readiness for the 4th industrial revolution. Chonsawat and Sopadang (2020) identified five indicators measuring readiness for revolution (4.0) for small businesses. The readiness indicators measured by organizational resilience, infrastructure systems, manufacturing systems, data transformation and digital technology. Organizational resilience is an organization's ability to survive internal and external disruptions through planning, and to recover and adapt quickly (Brooks *et al.*, 2015). System infrastructure is a series of compounds that support operations and communication in an organization so that communication runs more effectively and efficiently (Braccini & Margherita, 2019). A manufacturing system is the ability of businesses to convert raw goods into finished goods using adequate equipment (Kliestik *et al.*, 2020). Data transformation is the ability of businesses to obtain

information about a problem that can be measured through the conversion of data into other forms or formats, so that they can easily interpret the data obtained (Müller *et al*., 2021). Digital technology is an important point in Industrial Revolution 4.0, which focuses on utilizing and operating digital tools connected to digital technologies such as IoT, Cloud, and Ai (Braccini & Margherita, 2019). The indicators are intended be measured quantitatively and to obtain more accurate results than qualitative analysis.

SME Performance

Performance variable encompasses overall business performance enhancement. Figure 1 illustrated research model by leveraging digital transformation and gauging readiness for the fourth Industrial Revolution. Measurement indicators on SME performance can be determined into four factors, the influence on production operations management (Chonsawat & Sopadang, 2020; Felsberger & Reiner, 2020), marketing management (Arobo, 2022; Bruce *et al*., 2023; Dumitriu *et al*., 2019; Selase *et al*., 2019)financial management (Daud *et al*., 2022; Faraz *et al*., 2019; Yaniar *et al*., 2021), as well as human resource management (Salsabila & Rahadi, 2020; Setyowarni & Prihatiningtyas, 2022; Yas *et al*., 2020).

RESEARCH METHODS

Research method and sampling

This study focuses on the importance of digital technology adoption for MSME FnB sector performance in Bogor region which has the largest number of Culinary MSMEs in Indonesia is approximately 702,481 (Jabar, 2023). Data collection was conducted offline or using similar tools, and spanned from January to February 2024. The selected respondents are culinary MSMEs that have adopted at least one type of digital technology. Likert scale was used to assess perspectives on technological transformation, SME performance, and readiness for the fourth Industrial Revolution. This study used the criteria of an inverse R Square which has the higher model value with a path coefficient value of 0.11 to 0.2 (Hair *et al*., 2021). The significance level is 10 percent, therefore a minimum sample size of around 113 respondents is required. The minimum sample can be calculated by the equation which can be seen at Equation 1.

$$\text{Significance level} = 10\%: n_{\min} > \left(\frac{2.123}{|Pmin|}\right)^2 \quad (1)$$

The definition of Micro Small Enterprises that use technology in this study is that they can apply and adopt one of the technologies offered in the Industrial Revolution era of 4.0. In the field of operation and production, an integrated system can be implemented as an automatic information provider to plan product production and record raw-material inventories. The Internet is used to access the most efficient raw material prices and monitor the price of a material. Using automated machines for labor efficiency and hygienic processing of a product by minimizing product contact with human hands. Social networking connections expand market reach through online promotion and marketing by leveraging platforms and influencers to market products. The use of online storage and devices through big data and Cloud Computing can more quickly analyze past data history related to the decline and increase in income, turnover, and monitoring of the performance of workers connected in real time. Digital technology can also be used to make digital payments through various application platforms using mobile devices connected to the Internet.

Data analysis and variable model

This study featured three variable types: independent (Adpt), mediator (RI), and dependent (Perf) with using Structural Equation Modeling (SEM) for analysis. Readiness Indicator denotes MSMEs' readiness for the 4th industrial revolution. Chonsawat and Sopadang (2020) identified five indicators measuring readiness for revolution (4.0) for small businesses. There are five dimensions: organizational resilience, infrastructure system, manufacturing system, data transformation, and digital technology. Performance variable encompasses overall business performance enhancement. Figure 1 illustrated research model by leveraging digital transformation and gauging readiness for the fourth Industrial Revolution.

The aim is to boost MSMEs' business performance. Thus, the following hypothesis is proposed: (H1) The adoption of digital technology can affect the business performance of MSMEs; (H2) The adoption of digital technology can affect the readiness of MSMEs; (H3) The readiness for facing 4th Industrial Revolution can affect the business performance of MSMEs; (H4) The adoption of digital technology can affect business performance through readiness indicators for MSMEs.

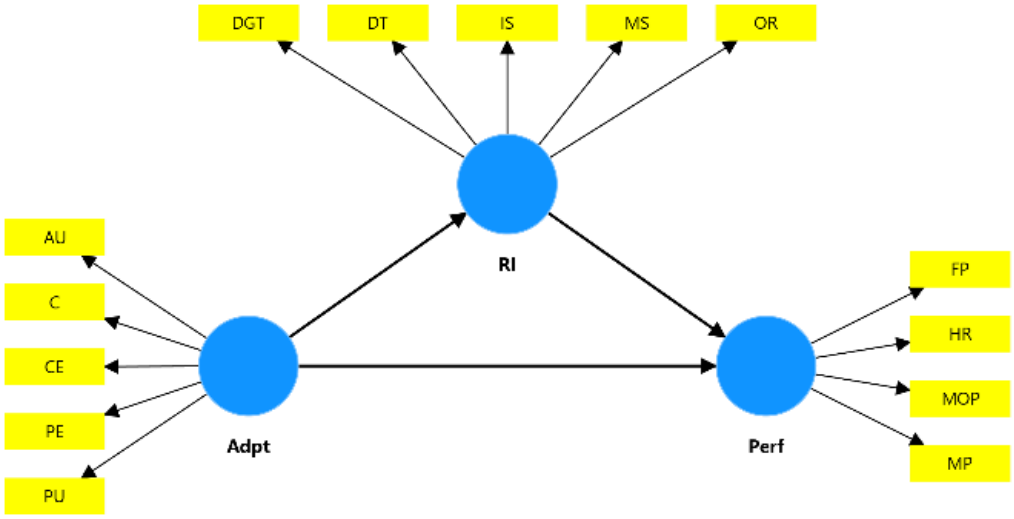

Figure 1. Research Model Structure

This study employed structural equation modeling (SEM) to analyze the causal relationships within planned models, particularly focusing on the impact of digital technology adoption on SME performance (Teng *et al*., 2022). Inner model testing was conducted using Smart PLS 4.0. Digital technology adoption was assessed using the Technology Acceptance Model (TAM), which considers perceived usability, ease of use, compatibility, and cost efficiency (Selase *et al.*, 2019). Validity and reliability testing in SEM, known as the outer model, is crucial for ensuring unbiased and dependable data representation. Convergent validity is assessed through loading factor criteria > 0.70 and AVE calculation > 0.50. Reliability testing utilizes Cronbach's alpha and composite reliability (rho_c) test criteria > 0.70 (Cronbach, 1951) to confirm the relationships between questionnaire aspects and dimensions.

The path coefficient was used to test the effect directly, and the specific indirect effect was used to test the mediating variables on pathways and research hypotheses. The criterion for testing the path coefficient was p-value below 0.05, meaning that was a significant influence and if the p-value above 0.05, there is no significant influence between the variables. According to Hair *et al.* (2021), a specific indirect effect must have

a p-value less than 0.05 to indicate mediation. If the p-value is greater than 0.05, it suggests there is no mediation.

RESULTS AND DISCUSSION

Validity and Reliability

The validation and reliability criteria were based on convergent validity through loading factor values, and AVE tests, and reliability tests with composite reliability (rho_c) and Cronbach's alpha. Based on the calculation in Table 1, regarding the validity of respondents in Indonesia, there are several invalid indicators, including compatibility (0.693) with variable indicators of digital technology adoption and variable readiness indicators, namely infrastructure systems (0.681) and digital technology (0.649).

Table 1. Validity and Reliability construct

Constructs	Code	Indonesia				
		Loading	Validity	Composite reliability	Cronbach's alpha	AVE
Adpt	PU	0.802	Valid	0.864	0.790	0.615
	PE	0.827	Valid			
	C	0.693	Invalid			
	CE	0.743	Valid			
	AU	0.762	Valid			
RI	OR	0.874	Valid	0.847	0.737	0.650
	IS	0.681	Invalid			
	MS	0.717	Valid			
	DT	0.820	Valid			
	DGT	0.649	Invalid			
Perf	MOP	0.831	Valid	0.869	0.799	0.624
	MP	0.808	Valid			
	FP	0.752	Valid			
	HR	0.767	Valid			

The strongest influence of the valid indicators was on the organizational resilience indicator (0.874), whereas the least influence is on the manufacturing system indicator (0.717). AVE calculations are intended to explain how well the variable of one factor is compared with the error variance. The results show that the AVE value of the respondents exceeds the > 0.7 criterion value. The composite reliability (rho_c) and Cronbach's alpha values were greater than the threshold value, which was greater than 0.7. The results of the discriminant validity assessment show that the three test variables provide valid results because they have a higher squared AVE value than the square between other variables, or the test criteria have a value of more than 0.5. The three variables tested had a fairly good ability to explain the constructs measured

Structural Path Analysis Model

Model structure testing criteria can be measured by testing R-square and F-square values, as well as goodness of FIT testing. The results of the analysis (Table 2) shows that the adoption of digital technology has a significant influence on readiness indicators.

Table 2. R-square output

Indicators	R-square	R-square adjusted	Output (Hair *et al*., 2013)
Perf	0.548	0.540	Moderate model
RI	0.315	0.309	Moderate model

The R-square value was used to measure how well the variability in the dependent variable could be explained by the independent variable in the regression model. The R-square values show that approximately 31.5 percent of the variability of readiness indicators can be explained by the variability in digital technology adoption. The data obtained are sufficient to explain the variable indicators of the influence of digital technology adoption of 54.8 percent on the business performance of MSMEs. R-squared testing based on the results shows that the research objects have a "moderate" structural model.

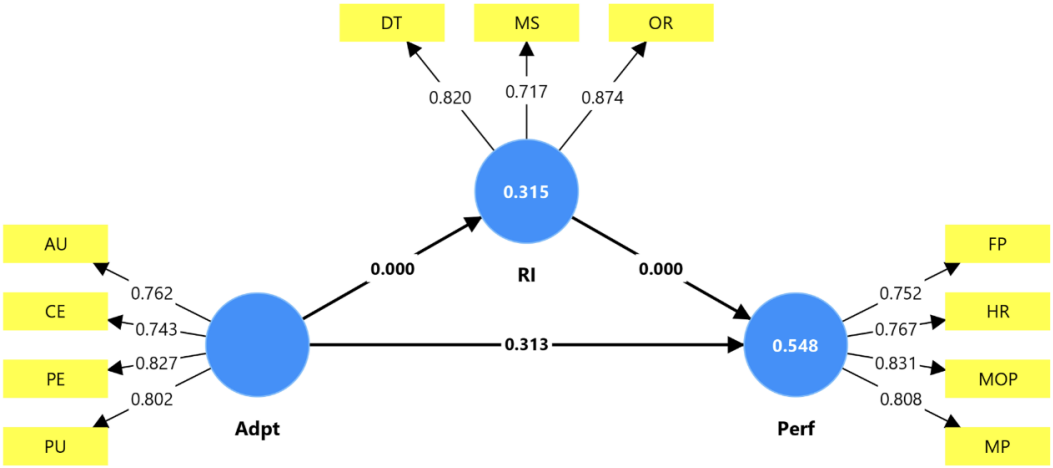

Figure 2. Evaluated variables and structural path analysis

F-square is a measure of the effect of the independent variable in the regression model on the dependent variable. Based on the results of testing the digital technology adoption variable on business performance variables, the F-square can be classified as having a "small effect" because it has a value below the threshold of 0.15. This proves that the indicators contained in the digital technology adoption variable have not been able to prove an improvement in business performance. Respondent Indonesia has an F-square value of 0.009 which means that the influence of digital technology adoption has a 0.9 percent increase in business performance. Business actors who adopt only digital technology have a very small level of influence and do not show effectiveness in good performance improvement.

H1: *The adoption of digital technology can affect MSMEs' business performance.*

The results of the path analysis testing with a p-value are supported by the F-square values. The p-value for all objects does not meet the threshold criterion, which is less than 0.05. This study proves that the F-square relationship is inversely proportional to the value of Pvalue. Based on the data, F-square has a low value, while the P value is 0.313. These results indicate that the adoption of digital technology has a high chance of success in improving business performance. As much as 31 percent of the possibility of increasing business in MSMEs in Indonesia is influenced by factors other than digital technology adoption.

Table 3. F-square output and p-value

Indicators	Mean	F-square	Output (Cohen, 1988)	P-value
Adpt –> Perf	0.077	0.009	Small effect	0.313
Adpt –> RI	0.569	0.460	Large effect	0.000
RI –> Perf	0.697	0.729	Large effect	0.000

The F-square value shows that the effect of digital technology adoption on readiness indicators and the influence of readiness indicators on business performance exceeding 0.35 treshold can be classified as a large effect. A large F-squared value indicates that the independent variable significantly influenced the dependent variable. This confirms that the model is powerful for predicting readiness indicators based on the adoption of digital technology and business performance. Data from respondents showed results of 0.460 and 0.729 respectively. Respondents were able to explain that the digital technology adoption and readiness indicator variable can significantly affect the variable performance of small and micro businesses by 46 percent and 72.9 percent respectively. The first attempt to change the business system to digital will certainly not immediately have a major impact on the business, often failing to adopt the technology. Periodic evaluation of digital systems through the perception of usefulness, ease of use, and adjustments to the business system is needed, mainly focusing on performance measurement (Costa Melo *et al.*, 2023). Therefore, a repeatable pattern is required to continue the learning and evaluation. This is similar to the discovery of strategies for implementing new technology in three stages: planning, enactment, and review (Barrane *et al*., 2021).

H2: *Digital technology adoption can affect MSMEs' readiness.*

H3: *Readiness to facing 4th Industrial Revolution can affect MSMEs' business performance.*

The next test tested the path hypothesis by examining p-value criteria. The hypothesis can be answered if the p-value meets the threshold, which is less than 0.05. The results obtained had a p-value of 0.000. Based on this value, it can be concluded that the adoption of digital technology can greatly affect the level of readiness of MSMEs to run a business in the era of the fourth industrial revolution, and the readiness indicator variable is highly influential on business performance variables. The Industrial Revolution 4.0 readiness indicators vary depending on the objectives and subjects to be studied. The following is the adoption of pillar measurements and elaboration of assessment indicators on the readiness of an MSME to face Industrial Revolution 4.0. Chonsawat & Sopadang (2020) identified five indicators can be a readiness predictor for MSMEs facing Industrial Revolution 4.0 (Chonsawat & Sopadang, 2020).

Table 4. Spesific indirect effect

	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P values
Adpt -> RI -> Perf	0.390	0.397	0.049	7.944	0.000

H4: *The adoption of digital technology can affect the business performance through readiness indicator for MSMEs*

The role of mediator variables has a special analysis that can be assessed through specific indirect effect testing, as shown in Table 4. This test was conducted to determine some of the roles resulting from the variable adoption of digital technology, showing it influence on business performance and MSMEs. The results of the statistical tests show that the p-value (0.000) is less than the threshold of 0.05, which shows a very significant effect. The readiness indicator variable plays an important role in connecting digital technology adoption and business performance. Thus digital technology can be easily applied, has an impact on business, can help problems before using technology, and most

importantly, in compatibility with business needs, both in terms of usefulness and cost-effectiveness to adopt the technology (Selase *et al*., 2019). People in MSME play a critical role in applying technology that is influenced by knowledge, desire, and attitude toward change using new technology (Bruce *et al*., 2023).

Managerial implication

The findings on the impact of digital technology adoption on readiness and business performance of Indonesian culinary MSMEs highlight several managerial implications. MSME managers should prioritize enhancing organizational readiness for Industrial Revolution 4.0 by investing in infrastructure, training, and systems that support digital integration. While digital adoption has shown a small direct impact on performance, its significant influence when combined with readiness indicators suggests that a strategic and holistic approach is necessary. Comprehensive training programs, data-driven decision-making, and supportive government policies are crucial for facilitating this transformation. By aligning digital technologies with broader business strategies, MSMEs can effectively improve their performance and sustainability at competitive digital era.

CONCLUSIONS

One of the industries that is developing massively in a country is a group of micro-, small-, and medium-sized enterprises. Even though they have capacity and income that are not comparable to large businesses, micro and small enterprises can have a very large impact on economic turnover to the bottom social groups. Culinary Micro Small Enterprises have a challenge at least to survive and continue to run their business in the midst of competitive competition, motivating changes in business models that are suitable to keep up with the times. Digital technology has developed rapidly over the last decade and is expected to improve business performance. Based on the results of the analysis in this study, the Technology Acceptance Model (TAM) method has not been able to prove the influence of the use of various kinds of digital technology by business actors on improving business performance. Readiness Indicators are composed of five aspects: organizational resilience, system infrastructure, manufacturing systems, data transformation, and digital technology, and are representative of all aspects of management that may be applied to all micro and small business activities. Readiness Indicator is here to be an important aspect in linking the use of digital technology to improving business performance. The adoption of digital technology by business owners must be accompanied by an increase in the capability of all business actors to utilize all aspects contained in Readiness Indicators. Effective adoption of digital technologies must be coupled with the enhanced capabilities of business actors to leverage these readiness indicators for improved performance.

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