Enhancing Information Technology Adoption Potential in MSMEs: a Conceptual Model Based on TOE Framework

Ainayah Syifa Hendri[1*], Endah Sudarmilah[2]

[1,2]*Magister of Informatics Study Program, Universitas Muhammadiyah Surakarta, Indonesia*

*corr_author: l280220010@student.ums.ac.id

Abstract - The adoption of Information Technology (IT) by Micro, Small, and Medium Enterprises (MSMEs) has become essential in the digital era. Nevertheless, challenges persist, such as enhancing IT adoption in the MSMEs sector and optimizing its benefits. This research aims to create a comprehensive model based on the Technology-Organization-Environment (TOE) framework by analyzing technological, organizational, and environmental factors influencing IT adoption among MSMEs in Pangandaran, Indonesia. Employing a quantitative approach, an online questionnaire was distributed to MSMEs, and data were analyzed using Partial Least Square-Structural Equation Modeling (PLS-SEM) through SmartPLS. The study significantly contributes to understanding IT adoption, emphasizing organizational context as the primary predictor, followed by technological and environmental contexts. Positive relationships were found between four contextual constructs: complexity, top management support, organizational readiness, and competitive pressure towards IT adoption in MSMEs. Conversely, compatibility and government support exhibited negative impacts. These findings have practical implications for Indonesian MSMEs by enhancing understanding of factors influencing IT adoption to support business operations. Furthermore, these findings hold the potential to assist MSMEs and the Indonesian government in optimizing IT adoption success. The generated data can be employed by MSMEs management authorities to devise strategies for enhancing IT adoption among MSMEs.

Keywords: IT adoption, MSMEs, TOE, PLS-SEM

I. INTRODUCTION

In the current era of digital transformation, the utilization of Information Technology (IT) has become a key factor in successfully addressing the increasingly complex challenges of business [1]. The Micro, Small, and Medium Enterprises (MSMEs) sector plays a crucial role in economic growth [2]. This sector serves as a key driver for national [3] and international economic development [4]. In many countries, including Indonesia, MSMEs are considered the economic foundation, making substantial contributions to economic recovery and social inequality reduction. Therefore, the sustainability of MSMEs must be maintained to avoid negative impacts on the economy and the nation's social standing [5].

Several key issues pose challenges for MSMEs in adopting IT. Firstly, MSMEs often struggle to comprehend and select new technologies or systems that align with their needs and integrate them into their business operations [6]. Secondly, organizational factors, such as a lack of skilled human resources or organizational competence, contribute to these challenges [7]. Thirdly, the inability of MSMEs to adopt and leverage IT can also be influenced by environmental conditions, such as the lack of IT infrastructure availability and policy and regulatory support [8]. Therefore, the extent to which MSMEs can adopt and utilize IT effectively and efficiently is crucial for success in overcoming these challenges.

Previous research aimed to analyze factors influencing technology implementation in MSMEs [9]-[11]. These studies encompass various aspects, such as those utilized to enhance management effectiveness [12], performance improvement [10], [13], and company market expansion [14]-[15]. Previous research has implemented various theories of IT adoption, such as the Technology Acceptance Model (TAM), Diffusion of Innovation (DoI), and Unified Theory of Acceptance and Use Of Technology (UTAUT). The TOE (Technology, Organization, and Environment) framework was chosen because it can examine how organizational characteristics influence technology adoption decisions, divided or expanded into three categories: (a) technology; (b) organization; and (c) environmental context [16]-[17]. "Moreover, the Technology-Organization-Environment (TOE) theory stands as the most validated framework for investigating the adoption of new technologies at the organizational level [18]. After reviewing existing literature on TOE-based

innovation adoption and considering the characteristics of the organizational and environmental environments, particularly in Indonesia, this research model presents relevant constructs.

The problem statement in this study is as follows: 1). What are the factors influencing the adoption of IT among MSMEs?, 2). How can the development of an IT adoption model based on the TOE framework contribute to improving the level of IT adoption among MSMEs?, 3). How can the proposed model enhance the effectiveness of IT adoption in MSMEs?. Thus, this research aims to develop a comprehensive model based on the TOE framework. This framework can be utilized to understand, analyze, and enhance the success rate of IT adoption among MSMEs.

The following discussion describes the three factors, constructs, and the research hypotheses.

A. Technology Factors

The qualities and capacities of the technology itself are referred to as technological factors [19]. Complexity is the difficulty of understanding and implementing innovation to achieve business goals, requiring more effort to find ways to use innovation [20]. Then, one of the main components influencing IT adoption by MSMEs is compatibility [21]-[23]. The extent to which creativity blends with a company's procedures, technical systems and processes can be calculated in terms of compatibility [24]. Thus, the following hypothesis is formulated:

Hypothesis 1 (H1): Complexity has a significant and positive impact on IT adoption in MSMEs.

Hypothesis 2 (H2): Compatibility has a significant and negative impact on IT adoption in MSMEs.

B. Organizational Factors

Organizational factors explain organizational elements that impact the implementation of the latest and innovative technology by the organization [25]. Top Management Support (TMS) is an essential factor in influencing an organization's choice to implement new technology or systems [26]. Therefore, support from top management is needed to foster creativity in the organization [27]. Then, A company is considered ready for business when it has the necessary services to implement technology [28]. The capacity of MSMEs to use IT will increase with improving supportive conditions. Thus, the following hypothesis is formulated:

Hypothesis 3 (H3): Top Management Support has a significant and positive impact on IT adoption in MSMEs.

Hypothesis 4 (H4): Organizational Readiness has a significant and positive impact on IT adoption in MSMEs.

C. Environmental Factors

The environmental TOE model construction explains how external pressure impacts how quickly businesses adopt new technology [29]. Competitive pressure is crucial for innovation adoption [30]. Rapid technological industry developments force companies to compete and be aware of the latest advancements by their competitors. Then, Government support refers to the opportunities and government initiatives to encourage innovation [31][32]. Favorable business and corporate tax laws can be enacted by the government to increase IT usage in organizations or companies. Thus, the following hypothesis is formulated:

Hypothesis 5 (H5): Competitive Pressure has a significant and positive impact on IT adoption in MSMEs.

Hypothesis 6 (H6): Government Support has a significant and positive impact on IT adoption in MSMEs.

The hypotheses regarding interactions among factors are illustrated in the conceptual model in Fig. 1.

II. METHOD

This section outlines the procedures undertaken to complete the study, consisting of nine steps. The research flow is depicted in Fig. 2.

A. Research Type

The researcher employs a quantitative approach. To formulate hypotheses, the researcher reviews literature published on SMEs and technology adoption. Subsequently, a questionnaire is developed and evaluated based on expert feedback.

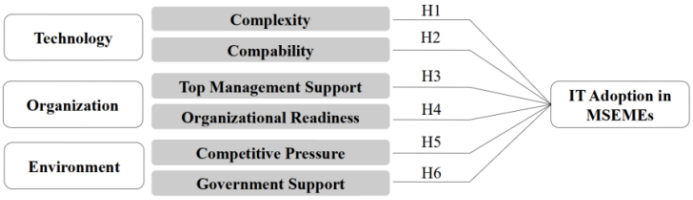

Fig. 1 Conceptual model

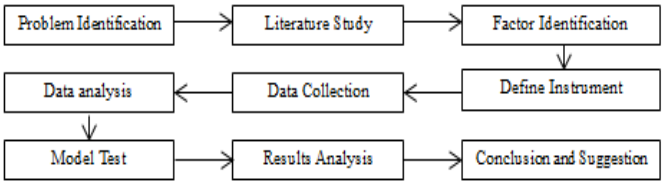

Fig 2. Research flow

B. Population and Research Sample

The study's population consists of several MSMEs that are part of the WhatsApp group for MSMEs in Pangandaran. The research sample is non-probability sampling with a purposive sampling technique. The criteria used in this study are SMEs located in Pangandaran, and the business has been running for at least 1 year.

C. Questionnaire Design

The research questionnaire comprises three sections. Section A contains demographic questions about the respondents, section B contains information about the organization, and section C includes questions about various constructs in the research model.

D. Data Collection Technique

An online questionnaire was developed using Google Forms and distributed to respondents. Respondent responses were quantified using a five-point Likert scale, with response options ranging from 1 ("strongly disagree") to 5 ("strongly agree"). This scale was utilized to evaluate question items constructing exogenous variables (technology factors, organizational factors, environmental factors), as well as the intervening variable (IT usage)."

E. Data Analysis Technique

Data were categorized by gender, position, age, industry classification, and firm size. Statistical analysis and correlation were conducted using SmartPLS as renowned software program for Partial Least Squares Structural Equation Model (PLS-SEM).

F. Validity and Reliability

Composite Reliability (CR) and Cronbach's alpha assessed the research instrument's reliability. This study ensured convergent and discriminant validity. Latent variables were deemed reliable with CR and Cronbach's alpha values surpassing 0.70. Convergent validity used Average Variance Extracted (AVE), exceeding 0.50. Discriminant validity was verified by the square root of AVE, surpassing construct correlations.

III. RESULT AND DISCUSSION

This section comprises respondent characteristics and demographic profiles, measurement models, followed by the structural model.

A. Characteristics and Demographic Profiles of Respondents

The demographic characteristics of respondents and their companies are presented in Table I. Based on the research findings, the majority are women (60.3%), holding the position of CEO or business owner actively involved in day-to-day operations (79.4%). Most respondents are aged between 20-30 years (38.1%). Concerning industries, the majority of respondents have businesses in accommodation, food, and beverage sectors (46%). Regarding the company size category, most respondents have 1–4 employees (66.7%).

B. Measurement Model

Reliability and validity must be assessed before testing hypotheses [33]. The study's average variance extracted (AVE), reliability, and convergent validity are shown in Table II. The idea behind convergent validity is that there should be a strong correlation between the measures of a construct; this is usually indicated by factor loading values of at least 0.70. The term "reliability" describes the degree of trustworthiness or dependability of a measurement tool; this is often determined by Composite Reliability (CR) and Cronbach's Alpha values of ≥ 0.70. The coefficient known as AVE, which is usually expressed in terms of values > 0.50, is responsible for explaining the variance in indicators that can be explained by the common component. The factor loading values, CR, Cronbach's alpha, and AVE, satisfy the suggested standards. The results of the measurement model are illustrated in Fig. 3.

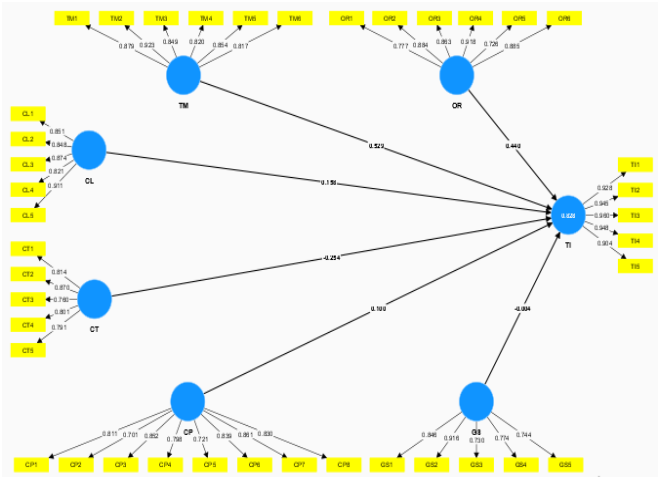

Fig. 3 Measurement model

TABLE I
INFORMATION ON CHARACTERISTICS AND DEMOGRAPHIC PROFILE OF RESPONDENTS

Demographic		Frequency	Percentage
Gender	Male	25	39.7%
	Female	38	60.3%
Position	Staff members or operational employees	6	9.5%
	Manager or director, but not business owner	2	3.2%
	Business owner, but not involved in day-to-day operations	6	9.5%
	Business owner involved in day-to-day operations	50	79.4%
Age	20-30	24	38.1%
	30-40	19	30.2%
	40-50	12	19%
	>50	8	12.7%
Industry Classification	Processing or Manufacturing	5	7.9%
	Wholesale and Retail Trade (non-automotive)	10	15.9%
	Automotive Repair, Maintenance & Trade	3	4.8%
	Tourism	2	3.2%
	Agriculture, Forestry, and Fisheries	2	3.2%
	Accommodation, Food & Beverage	29	46%
	Technology, Information & Communication	4	6.3%
	Construction	3	4.8%
	Housing	1	1.6%
	Rental	4	6.3%
	Education	1	1.6%
	Arts & Entertainment	5	7.9%
	Other Services	5	7.9%
Firm Size	1-4 people	51	81%
	5-19 people	11	17.5%
	20-99 people	1	1.6%

This study examines discriminant validity by comparing the square root of AVE and the correlation coefficients between constructs using the criteria of Heterotrait-Monotrait (HTMT) suggested by Henseler et al. [34], Fornell & Larcker criteria [35], and Cross Loadings. The degree to which a construct differs from other constructs according to empirical standards is known as discriminant validity. Based on the requirements that each indicator's loading must be greater than all cross-loadings, Table III displays cross-loadings.

Table IV displays satisfactory values as the square root of the AVE for each construct is greater than the correlation coefficients between construct coefficients. It is clear from this that discriminant validity is appropriate.

The HTMT correlation ratio was used to further investigate discriminant validity. The HTMT correlation ratio data are shown in Table V, where all values are ≤ 0.90. Therefore, it can be concluded that respondents understand that the seven constructs are distinct. Thus, overall, this validity test indicates that the measurement items are valid and reliable.

C. Structural Model

Fig. 4 illustrates the structural model. Concerning the predictive capacity of the model, the R2 values were evaluated for six prediction constructs. The obtained results indicate that the R2 for technology adoption is 0.828. This implies that 82.8% of the variance in technology adoption can be elucidated by factors such as complexity, compatibility, top management support, organizational readiness, competitive pressure, and government support. Threshold values used to assess the R2 are 0.25 (depicted as weak), 0.50 (depicted as moderate), and 0.75 (depicted as substantial). According to the PLS algorithm, the R2 for technology adoption is 0.828. This signifies that the six contextual readiness constructs collectively explain 82% of the variance in technology adoption. Therefore, the conceptual model demonstrates a highly adequate predictive capacity in elucidating technology adoption.

TABLE II
CONVERGENT VALIDITY AND RELIABILITY

Construct	Item	Loadings	Cronbach's alpha	rho_a	CR	AVE
Complexity	CL1	0.851	0.913	0.919	0.935	0.743
	CL2	0.848				
	CL3	0.874				
	CL4	0.821				
	CL5	0.911				
Compatibility	CT1	0.814	0.867	0.874	0.904	0.653
	CT2	0.870				
	CT3	0.760				
	CT4	0.801				
	CT5	0.791				
Top Management Support	TM1	0.879	0.928	0.931	0.943	0.736
	TM2	0.923				
	TM3	0.849				
	TM4	0.820				
	TM5	0.854				
	TM6	0.817				
Organizational Readiness	OR1	0.777	0.918	0.927	0.937	0.714
	OR2	0.884				
	OR3	0.863				
	OR4	0.918				
	OR5	0.726				
	OR6	0.885				
Competitive Pressure	CP1	0.811	0.921	0.928	0.936	0.646
	CP2	0.701				
	CP3	0.852				
	CP4	0.798				
	CP5	0.721				
	CP6	0.839				
	CP7	0.861				
	CP8	0.830				
Government Support	GS1	0.846	0.869	0.931	0.901	0.648
	GS2	0.916				
	GS3	0.730				
	GS4	0.774				
	GS5	0.744				
Information Technology Adoption	TI1	0.928	0.965	0.967	0.973	0.878
	TI2	0.945				
	TI3	0.960				
	TI4	0.948				
	TI5	0.904				

TABLE III
CROSS LOADING

	CL	CP	CT	GS	OR	TI	TM
CL1	**0.851**	0.352	0.552	0.234	0.584	0.553	0.559
CL2	**0.848**	0.328	0.525	0.056	0.558	0.532	0.502
CL3	**0.874**	0.459	0.663	0.080	0.627	0.614	0.630
CL4	**0.821**	0.383	0.634	0.283	0.589	0.595	0.583
CL5	**0.911**	0.497	0.662	0.192	0.693	0.680	0.617
CP1	0.401	**0.811**	0.632	0.443	0.749	0.669	0.713
CP2	0.349	**0.701**	0.580	0.351	0.581	0.464	0.624
CP3	0.236	**0.852**	0.495	0.214	0.434	0.428	0.442
CP4	0.382	**0.798**	0.647	0.343	0.554	0.529	0.582
CP5	0.247	**0.721**	0.418	0.088	0.571	0.542	0.498
CP6	0.424	**0.839**	0.497	0.164	0.589	0.629	0.576
CP7	0.476	**0.861**	0.517	0.241	0.576	0.632	0.620
CP8	0.471	**0.830**	0.506	0.243	0.545	0.564	0.558
CT1	0.551	0.559	**0.814**	0.321	0.638	0.587	0.693
CT2	0.664	0.623	**0.870**	0.378	0.685	0.606	0.687
CT3	0.414	0.412	**0.760**	0.248	0.534	0.442	0.589
CT4	0.461	0.602	**0.801**	0.334	0.644	0.560	0.628
CT5	0.749	0.476	**0.791**	0.230	0.528	0.538	0.653
GS1	0.297	0.317	0.368	**0.846**	0.332	0.362	0.437
GS2	0.127	0.226	0.280	**0.916**	0.204	0.260	0.298
GS3	0.151	0.191	0.359	**0.730**	0.207	0.158	0.295
GS4	0.083	0.324	0.293	**0.774**	0.223	0.239	0.336
GS5	0.038	0.214	0.198	**0.744**	0.137	0.158	0.296
OR1	0.454	0.501	0.535	0.236	**0.777**	0.601	0.593
OR2	0.603	0.667	0.662	0.366	**0.884**	0.761	0.781
OR3	0.559	0.717	0.695	0.305	**0.863**	0.743	0.728
OR4	0.692	0.659	0.689	0.239	**0.918**	0.799	0.710
OR5	0.588	0.504	0.530	0.090	**0.726**	0.630	0.507
OR6	0.688	0.603	0.688	0.222	**0.885**	0.747	0.653
TI1	0.678	0.679	0.691	0.351	0.837	**0.928**	0.823
TI2	0.641	0.712	0.680	0.309	0.813	**0.945**	0.832
TI3	0.684	0.662	0.642	0.324	0.764	**0.960**	0.828
TI4	0.617	0.699	0.625	0.238	0.803	**0.948**	0.787
TI5	0.631	0.549	0.548	0.261	0.759	**0.904**	0.696
TM1	0.610	0.615	0.745	0.382	0.706	0.739	**0.879**
TM2	0.624	0.618	0.678	0.308	0.755	0.812	**0.923**
TM3	0.509	0.638	0.687	0.333	0.672	0.733	**0.849**
TM4	0.660	0.597	0.676	0.394	0.637	0.703	**0.820**
TM5	0.561	0.672	0.708	0.402	0.651	0.718	**0.854**
TM6	0.500	0.600	0.661	0.384	0.628	0.647	**0.817**

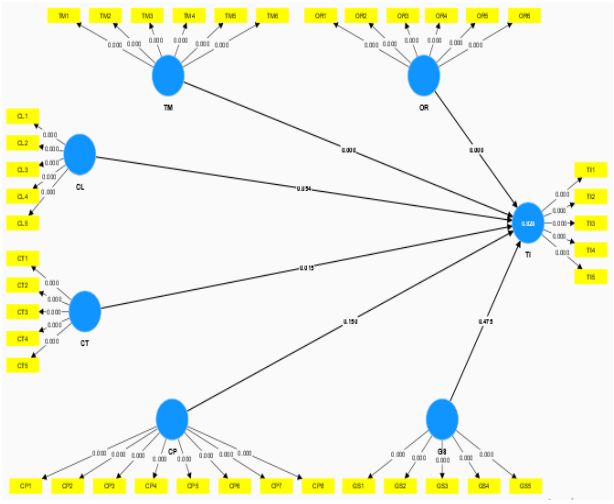

Fig. 4 Structural model

This study used bootstrapping technique for additional statistical evaluation, and the outcomes are shown in Table VI. The study evaluated the hypothesized relationships and path coefficients among the constructs. Path coefficients have values ranging from -1 to 1. If the value falls within 0 to 1, it is considered positive, whereas if the value is within -1 to 0, it is considered negative. The results, as depicted in Fig. 5, indicate a positive relationship for four contextual constructs: complexity, top management support, organizational readiness, and competitive pressure on IT adoption in SMEs, while compatibility and government support have a negative impact on IT adoption in SMEs. To further test the model hypotheses, t-statistics were evaluated. If T Statistics > 1.96, the impact is considered significant. Subsequently, a hypothesis is accepted to have a significant relationship if the p values < 0.05. Table 8 presents the results of hypothesis testing in this study.

Hypothesis testing on the technological factor indicates that complexity does not have a significant influence on the adoption of IT in SMEs, which contradicts the research conducted by [36]. Conversely, compatibility has a significant influence on the adoption of IT in SMEs, as revealed by [37]. Furthermore, the results of hypothesis testing on the organizational factor state that top management support significantly affects the adoption of IT in SMEs, contrary to the research by [23]. Similarly, organizational readiness significantly affects the adoption of IT in SMEs, as indicated by [38]. Then, in the environmental factor, competitive pressure does not have a significant influence on the adoption of IT in SMEs, as revealed by [23]. Likewise, government support does not have a significant influence on the adoption of IT in SMEs, as indicated by [39] and [23]. This study also found a positive relationship between complexity, top management support, organizational readiness, and competitive pressure on the adoption of IT in SMEs. Whereas compatibility and government support have a negative relationship with the adoption of IT in SMEs.

TABLE IV
FORNELL-LARCKER CRITERION

Construct	CL	CP	CT	GS	OR	TI	TM
Complexity	**0.862**						
Competitive Pressure	0.474	**0.804**					
Compatibility	0.709	0.669	**0.808**				
Government Support	0.198	0.327	0.378	**0.805**			
Organizational Readiness	0.711	0.725	0.754	0.292	**0.845**		
Information Technology Adoption	0.694	0.706	0.682	0.318	0.843	**0.937**	
Top Management Support	0.674	0.726	0.807	0.425	0.789	0.848	**0.858**

TABLE V
HETEROTRAIT-MONOTRAIT RATIO (HTMT)

Construct	CL	CP	CT	GS	OR	TI	TM
Complexity							
Competitive Pressure	0.501						
Compatibility	0.785	0.741					
Government Support	0.211	0.354	0.419				
Organizational Readiness	0.771	0.775	0.838	0.302			
Information Technology Adoption	0.735	0.734	0.738	0.316	0.899		
Top Management Support	0.729	0.779	0.899	0.460	0.850	0.893	

TABLE VI
HYPOTHESES TESTING RESULTS

Hypotheses	Factor	Path	Coefficient	STDEV	T Statistics	P Values	Significance
H1	Technology	CL -> TI	0.158	0.098	1.607	0.054	Unsignificant
H2		CT -> TI	-0.254	0.117	2.177	0.015	Significant
H3	Organization	TM -> TI	0.529	0.122	4.316	0.000	Significant
H4		OR -> TI	0.440	0.103	4.283	0.000	Significant
H5	Environment	CP -> TI	0.100	0.096	1.037	0.150	Unsignificant
H6		GS -> TI	-0.004	0.056	0.064	0.475	Unsignificant

Thus, it can be said that some key factors underlying SMEs adopting IT are technological compatibility, top management support, and organizational readiness. If SMEs have suitable technology, receive support from top management, and the organization has good readiness, they will adopt IT and explore online platforms related to their business until they find the platform most beneficial for their business endeavors.

Resistance to complexity may stem from the lack of specificity in the applications being assessed, leading to respondent bias in evaluating the ease of use of IT. Respondents' perceptions of ease of use may vary depending on the range of apps they have mastered and utilized. Because the applications that the participants in this study utilized were not under the researchers' control, some participants may have found it difficult to use one application while finding it easy to use another. These variations may have an impact on respondents' ultimate perceptions.

The lack of significant influence of competitive pressure on IT adoption in this study may be due to the limited market competition in small towns in Indonesia, thus there is not much pressure from competitors affecting SMEs in adopting IT. Government support also does not affect the use of IT due to the government's lack of knowledge about the conditions and readiness of SMEs, especially in developing countries like Indonesia. The readiness of SMEs includes the experience and ability they possess in utilizing IT in their business activities. Each SME faces different challenges and needs.

Therefore, this research provides a new conceptual model different from previous studies, which can be observed in Fig. 5.

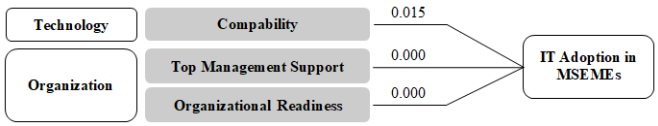

Fig. 5 The developed conceptual model

This research contributes to the existing literature on Information Technology (IT) adoption by companies, aiming to enhance the utilization of IT to derive benefits among Micro, Small, and Medium Enterprises (MSMEs). The study theoretically addresses the limitations in the literature concerning IT adoption for MSMEs in Indonesia. This research fills the research gap in understanding the key factors influencing IT adoption. The researchers successfully explore the factors influencing IT adoption and ensure alignment with suggestions from prior literature. The findings of this research can be employed to formulate strategies and policies to enhance the level of IT adoption among MSMEs in Indonesia. Moreover, these findings offer insights to MSMEs regarding the factors influencing IT adoption. Ultimately, the study's findings are crucial for policymakers and managers, potentially aiding in the improvement of IT implementation.

IV. CONCLUSION

The PLS algorithm reveals a robust R2 of 0.828 for IT adoption, denoting that the six contextual readiness constructs collectively contribute significantly, accounting for 82.8% of the variance in IT adoption. Organizational factors prove most influential, followed by technological and environmental aspects. Positive relationships are apparent between key contextual constructs: complexity, top management support, organizational readiness, and competitive pressure towards IT adoption in MSMEs. Conversely, compatibility and government support negatively impact MSMEs' IT adoption. This research significantly enhances understanding of the relationship between technological, organizational, and environmental factors and their impact on IT adoption in MSMEs. The study provides practical guidance for formulating effective IT adoption strategies for entrepreneurs and policymakers. It establishes a foundational framework for practitioners applying the TOE framework in the context of Indonesian MSMEs. Acknowledging methodological limitations, the research offers valuable insights into

addressing the challenge of low IT usage among MSMEs, stimulating further discussion and theoretical development for enhanced understanding. Recognizing limited generalizability to the Pangandaran population, future research should encompass diverse contexts. Adopting a mixed-methods approach, combining quantitative and qualitative research, holds potential for conceptual advancements beyond existing literature.

ACKNOWLEDGEMENT

This research and publication is sponsored by the Ministry of Education, Culture, Research, Technology and Higher Education of the Republic of Indonesia and Universitas Muhammadiyah Surakarta.

REFERENCES

[1] I. G. C. Putra, N. P. Y. Mendra, and L. G. Novitasari, "Integration of information technology capabilities in generating small and medium enterprise performance," *Uncertain Supply Chain Manag.*, vol. 11, no. 2, pp. 843–854, 2023, doi: 10.5267/j.uscm.2023.3.010.

[2] F. Kurniasari, E. D. Lestari, and H. Tannady, "Pursuing Long-Term Business Performance: Investigating the Effects of Financial and Technological Factors on Digital Adoption to Leverage SME Performance and Business Sustainability—Evidence from Indonesian SMEs in the Traditional Market," *Sustain.*, vol. 15, no. 16, pp. 1–20, 2023, doi: 10.3390/su151612668.

[3] J. Y. Lin, Z. Yang, Y. Li, and Y. Zhang, "Development strategy and the MSMEs finance gap," *J. Gov. Econ.*, vol. 5, p. 100034, 2022, doi: 10.1016/j.jge.2022.100034.

[4] J. Varga, "Defining the Economic Role and Benefits of Micro, Small and Medium-sized Enterprises in the 21st Century with a Systematic review of the Literature," *Acta Polytech. Hungarica*, vol. 18, no. 11, pp. 209–228, 2021, doi: 10.12700/aph.18.11.2021.11.12.

[5] M. Najib, A. A. A. Rahman, and F. Fahma, "Business Survival of Small and Medium-Sized Restaurants through a Crisis: The Role of Government Support and Innovation," *Sustain.*, vol. 13, no. 19, pp. 1–16, 2021, doi: 10.3390/su131910535.

[6] S. Buteau, "Roadmap for digital technology to foster India's MSME ecosystem—opportunities and challenges," *CSI Trans. ICT*, vol. 9, no. 4, pp. 233–244, 2021, doi: 10.1007/s40012-021-00345-4.

[7] J. Gao, A. B. Siddik, S. Khawar Abbas, M. Hamayun, M. Masukujjaman, and S. S. Alam, "Impact of E-Commerce and Digital Marketing Adoption on the Financial and Sustainability Performance of MSMEs during the COVID-19 Pandemic: An Empirical Study," *Sustain.*, vol. 15, no. 2, pp. 1–21, 2023, doi: 10.3390/su15021594.

[8] L. J. Cueto, A. F. D. Frisnedi, R. B. Collera, K. I. T. Batac, and C. B. Agaton, "Digital Innovations in MSMEs during Economic Disruptions: Experiences and Challenges of Young Entrepreneurs," *Adm. Sci.*, vol. 12, no. 1, pp. 1–25, 2022, doi: 10.3390/admsci12010008.

[9] N. A. Zapata Márquez, J. M. Medina Quintero, F. I. Morales Sáenz, and D. Abrego Almazán, "Critical Success Factors in Implementing IT in MSMEs," *Cuad. Adm.*, vol. 35, no. 63, pp. 3–14, 2019, doi: 10.25100/cdea.v35i63.6874.

[10] I. N. Nurcaya, I. K. Rahyuda, G. Ayu, K. Giantari, and N. Wayan, "The Effect of Information Technology on The Performance of MSMEs During the Covid-19 Pandemic," *Int. J. Soc. Sci. Bus.*, vol. 6, no. 2, pp. 262–267, 2022, doi: 10.23887/ijssb.v6i2.44260.

[11] S. Batra and D. A. Arora, "Adoption of E-Commerce in MSME Sector," *PalArch's J. Archaeol. Egypt / Egyptol.*, vol. 18, no. 9, pp. 5701–5710, 2020. Retrieved from https://archives.palarch.nl/index.php/jae/article/view/5078.

[12] A. ME, "Relevance of Information Technology in the Effective Management of Selected SMES in Lagos State Nigeria," *Acad. Strateg. Manag. J.*, vol. 17, no. 1, pp. 1–15, 2018. Available at SSRN: https://ssrn.com/abstract=3153292.

[13] H. Novrianda, A. Shar, and D. Arisandi, "Increasing Marketing Performance through Development of Market Orientation and Entrepreneurship Orientation (A Study on the Participation of Micro, Small and Medium Enterprises (MSMEs) in Bengkulu Province).," *Budapest Int. Res. Critics Inst. Humanit. Soc. Sci.*, vol. 5, no. 2, pp. 15084–15097, 2022, doi: 10.33258/birci.v5i2.5384.

[14] S. Suhartini, N. A. Mahbubah, and M. Basjir, "Marketing Strategy Design Based on Information Technology in Batik Small and Medium-Sized Enterprises in Indonesia," *Eastern-European J. Enterp. Technol.*, vol. 6, no. 13–114, pp. 39–48, 2021, doi: 10.15587/1729-4061.2021.244137.

[15] R. C. Jaya and F. Kosadi, "Optimization Of Online Selling Through Website-Based E-Commerce Applications And Mobile Applications For Msmes," *Ina. Community Serv. J.*, vol. 1, no. 1, pp. 1–12, 2022, doi: 10.56956/inacos.v1i1.31.

[16] J. C. F. Li, "Roles of Individual Perception in Technology Adoption at Organization Level: Behavioral Model Versus TOE Framework," *J. Syst. Manag. Sci.*, vol. 10, no. 3, pp. 97–118, 2020, doi: 10.33168/JSMS.2020.0308.

[17] T. H. Nguyen, X. C. Le, and T. H. L. Vu, "An Extended Technology-Organization-Environment (TOE) Framework for Online Retailing Utilization in Digital Transformation: Empirical Evidence from Vietnam," *J. Open Innov. Technol. Mark. Complex.*, vol. 8, p. 200, 2022, doi: 10.3390/joitmc8040200.

[18] S. Malik, M. Chadhar, and M. Chetty, "Factors Affecting the Organizational Adoption of Blockchain Technology: Extending the Technology Organization– Environment

(TOE) Framework in the Australian Context," *Sustainability*, vol. 13, p. 9404, 2021, doi: 10.24251/hicss.2021.680.

[19] A. A. Trawnih, A. S. Al-Adwan, A. Amayreh, T. Majali, and H. M. Al-Hattami, "Investigating The Adoption Of Social Commerce : A Case Study Of Smes In Jordan," *Interdiscip. J. Information, Knowledge, Manag.*, vol. 18, pp. 31–58, 2023, doi: 10.28945/5071.

[20] T. Mahakittikun, S. Suntrayuth, and V. Bhatiasevi, "The impact of technological-organizational-environmental (TOE) factors on firm performance: merchant's perspective of mobile payment from Thailand's retail and service firms," *J. Asia Bus. Stud.*, vol. 15, no. 2, pp. 359–383, 2020, doi: 10.1108/JABS-01-2020-0012.

[21] J. Nair, A. Chellasamy, and B. N. B. Singh, "Readiness Factors for Information Technology Adoption in SMEs: Testing an Exploratory Model in an Indian Context," *J. Asia Bus. Stud.*, vol. 13, no. 4, pp. 694–718, 2019, doi: 10.1108/JABS-09-2018-0254.

[22] N. H. Vu and N. M. Nguyen, "Development of small-and medium-sized enterprises through information technology adoption persistence in Vietnam," *Inf. Technol. Dev.*, vol. 28, no. 3, pp. 585–616, 2022, doi: 10.1080/02681102.2021.1935201.

[23] E. Tria Wahyuningtihas, Y. Giri Sucahyo, and A. Gandhi, "Driving Factors for MSMEs in Indonesia to Adopt Information Technology on Culinary," *ACM Int. Conf. Proceeding Ser.*, pp. 79–84, 2021, doi: 10.1145/3466029.3466055.

[24] H. Sallehudin *et al.*, "Performance and Key Factors of Cloud Computing Implementation in the Public Sector," *Int. J. Bus. Soc.*, vol. 21, no. 1, pp. 134–152, 2020, doi: 10.33736/ijbs.3231.2020.

[25] S. Wallace, K. Y. Green, C. M. Johnson, J. T. Cooper, and C. M. Gilstrap, "An Extended TOE Framework for Cybersecurity Adoption Decisions," *Commun. Assoc. Inf. Syst.*, vol. 47, pp. 338–363, 2020, doi: 10.17705/1cais.04716.

[26] O. I. Tawfik, O. Durrah, K. Hussainey, and H. E. Elmaasrawy, "Factors Influencing the Implementation of Cloud Accounting: Evidence from Small and medium Enterprises in Oman," *J. Sci. Technol. Policy Manag.*, vol. 14, no. 5, pp. 859–884, 2023, doi: 10.1108/JSTPM-08-2021-0114.

[27] M. D. Jakobsen, T. Clausen, and L. L. Andersen, "Can a participatory organizational intervention improve social capital and organizational readiness to change? Cluster randomized controlled trial at five Danish hospitals," *J. Adv. Nurs.*, vol. 76, no. 10, pp. 2685–2695, 2020, doi: 10.1111/jan.14441.

[28] A. Khayer, N. Jahan, M. N. Hossain, and M. Y. Hossain, "The adoption of cloud computing in small and medium enterprises: a developing country perspective," *VINE J. Inf. Knowl. Manag. Syst.*, vol. 51, no. 1, pp. 64–91, 2021, doi: 10.1108/VJIKMS-05-2019-0064.

[29] M. Lutfi, P. C. D. Buntuang, Y. Kornelius, Erdiyansyah, and B. Hasanuddin, "The impact of social distancing policy on small and medium-sized enterprises (SMEs) in Indonesia," *Probl. Perspect. Manag.*, vol. 18, no. 3, pp. 492–503, 2020, doi: 10.21511/ppm.18(3).2020.40.

[30] M. Salehi and G. Zimon, "The Effect of Intellectual Capital and Board Characteristics on Value Creation and Growth," *Sustain.*, vol. 13, no. 13, pp. 1–16, 2021, doi: 10.3390/su13137436.

[31] R. Yang, W. Tang, and J. Zhang, "Technology improvement strategy for green products under competition: The role of government subsidy," *Eur. J. Oper. Res.*, vol. 289, no. 2, pp. 553–568, 2021, doi: 10.1016/j.ejor.2020.07.030.

[32] A. Gui, Y. Fernando, M. S. Shaharudin, M. Mokhtar, I. G. M. Karmawan, and Suryanto, "Cloud Computing Adoption Using Toe Framework for Indonesia's Micro Small Medium Enterprises," *Int. J. Informatics Vis.*, vol. 4, no. 4, pp. 237–242, 2020, doi: 10.30630/joiv.4.4.458.

[33] R. P. Bagozzi, Y. Yi, and L. W. Phillips, "Assessing Construct Validity in Organizational Research," *Adm. Sci. Q.*, vol. 36, no. 3, p. 421, 1991, doi: 10.2307/2393203.

[34] J. Henseler, C. M. Ringle, and M. Sarstedt, "A new criterion for assessing discriminant validity in variance-based structural equation modeling," *J. Acad. Mark. Sci.*, vol. 43, no. 1, pp. 115–135, 2015, doi: 10.1007/s11747-014-0403-8.

[35] C. Fornell and D. f. larcke, "Evaluating Structural Equation Models with Unobservable Variables and Measurement Error," *J. Mark. Res.*, vol. 18, no. 1, pp. 39–50, 1981, doi: 10.2307/3151312.

[36] S. M. Chege, D. Wang, and S. L. Suntu, "Impact of information technology innovation on firm performance in Kenya," *Inf. Technol. Dev.*, vol. 26, no. 2, pp. 316–345, 2020, doi: 10.1080/02681102.2019.1573717.

[37] N. Kuruwitaarachchi, M. S. A. Yajid, A. Khatibi, and S. M. F. Azam, "Information Technology Factors Influence the Adoption to Ecommerce in Small and Medium Scale Organizations in Sri Lanka: A Research Agenda," *Int. J. e-Education, e-Business, e-Management e-Learning*, vol. 10, no. 1, pp. 95–103, 2020, doi: 10.17706/ijeeee.2020.10.1.95-103.

[38] A. Sani, N. N. P, A. Budiantara, M. Ivone, and S. Aisyah, "Analisa IT/IS Strategic Planning Terhadap Adopsi Teknologi Informasi Dalam Konteks Kinerja Organisasi Pada Umkm," *INFOTECH J. Technol. Inf.*, vol. 9, no. 2, pp. 199–206, 2023, doi: 10.37365/jti.v9i2.205.

[39] U. Chotijah and F. Retrialisca, "Analysis of Information Technology Readiness in Furniture Business in Indonesia," *Indones. J. Inf. Syst.*, vol. 3, no. 1, pp. 14–22, 2020, doi: 10.24002/ijis.v3i1.3470.