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FROM DIGITAL INCLUSION TO SUSTAINABLE BUSINESS: ANALYZING THE INFLUENCE OF IMDI AND HDI ON MSMES IN INDONESIA

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Abstract

Digital inclusion has become a crucial factor in supporting sustainable business growth in the Micro, Small, and Medium Enterprises (MSMEs) sector in Indonesia, especially through improving the quality of human resources and accelerating the adoption of information technology. This study aims to analyze the influence of the Human Development Index (HDI) and the Indonesian Digital Society Index (IMDI) on the MSME Business Index in 38 Provinces in Indonesia during the period 2022-2024. Utilizing panel data from the Central Bureau of Statistics (BPS), ministry of communication and digital (KOMDIGI), and the official website of Bank Rakyat Indonesia. This study adopts a quantitative approach using multiple linear regression, complemented by a series of classical assumption tests and statistical hypothesis validation to ensure the reliability of the model. The empirical findings show that IMDI contributes positively and significantly to the improvement of the MSME Business Index. In contrast, HDI has a significantly negative contribution. However, this opens up opportunities to direct human development to better support inclusive growth of MSMEs. The implications of this study highlight the synergy between human capacity development and digital inclusion as key drivers of economic sustainability based on circular economy principles and resilience of rural areas in Indonesia. This study makes an important contribution to the economic development and public policy literature, particularly in the context of MSME digitalization in developing countries.
Keywords: Digital inclusion, MSMEs, Sustainable Business, Economic Development

INTRODUCTION

Indonesia is now at a crucial point in its economic transformation process, where digitalization and human resource development serve as two main pillars that support each other to create inclusive and sustainable economic growth. In an increasingly interconnected world, the challenges faced by Indonesia are not merely about enhancing economic competitiveness but also ensuring that all segments of society, including Micro, Small, and Medium Enterprises (MSMEs), can actively participate in the digital economy. Rapid advancements in information and communication technology have created new opportunities for MSMEs to expand markets, improve efficiency, and accelerate innovation in their businesses (Bahtiar et al., 2025). However, these opportunities will only be fully realized if supported by high-quality human resources and an open and inclusive digital ecosystem (Budiarti & Firmansyah, 2024). Therefore, it is important to measure and analyze the Human Development Index (HDI) and the Indonesian Digital Society Index (IMDI) to understand how these two aspects contribute to the growth and resilience of the MSME sector across all provinces in Indonesia. Thus, in-depth research linking empirical data from official and reliable sources serves as a crucial foundation for formulating evidence-based development policies focused on equitable distribution of digitalization benefits across the entire nation.

Digital inclusion has become a crucial foundation in supporting the advancement of the Micro, Small, and Medium Enterprises (MSME) sector in Indonesia, particularly in the context of

digital economic transformation, which increasingly requires rapid adaptation to technological developments and improvements in human resource quality (Manapa & Er, 2024). The Indonesian government, through the Ministry of Communication and Information Technology, regularly measures and publishes the Indonesian Digital Society Index (IMDI), which in 2024 stood at 43.34, up from 43.18 the previous year, based on a survey of 514 districts/cities (Jaya et al., 2024). This increase in the IMDI, although still moderate, indicates a positive trend in the adoption of digital technology, while also revealing digital disparities between regions: only five provinces fall into the high index category, while most are in the moderate category and one province is in the low category, indicating uneven distribution of digital literacy and posing a challenge to the equitable distribution of the benefits of digital transformation across Indonesia (Jaya et al., 2024).

The strong correlation between digital inclusion, as indicated by the IMDI, and human development quality, as reflected in the Human Development Index (HDI), becomes increasingly clear when examining the performance of SMEs at the national level; Data from the Central Statistics Agency (BPS) and the United Nations Development Programme (UNDP) show that Indonesia's HDI for 2023-2024 stands at 0.713, an increase from the previous year, but it still faces challenges in the form of regional disparities, with the HDI in some underdeveloped areas still recorded at 0.588 (UNDP, 2023). This increase in the HDI indicates progress in education, health, and income, strengthening human resources' ability to adapt to technological changes and new business models, thereby providing greater opportunities for SMEs to grow faster and compete effectively in the digital era (Putri et al., 2024). However, uneven development in human development has left certain groups of society behind the main current of the digital economy, widening the gap and risking social-economic polarization. Therefore, data-driven policy interventions are urgently needed to ensure that digital inclusion has a broad and fair impact (UNDP, 2023).

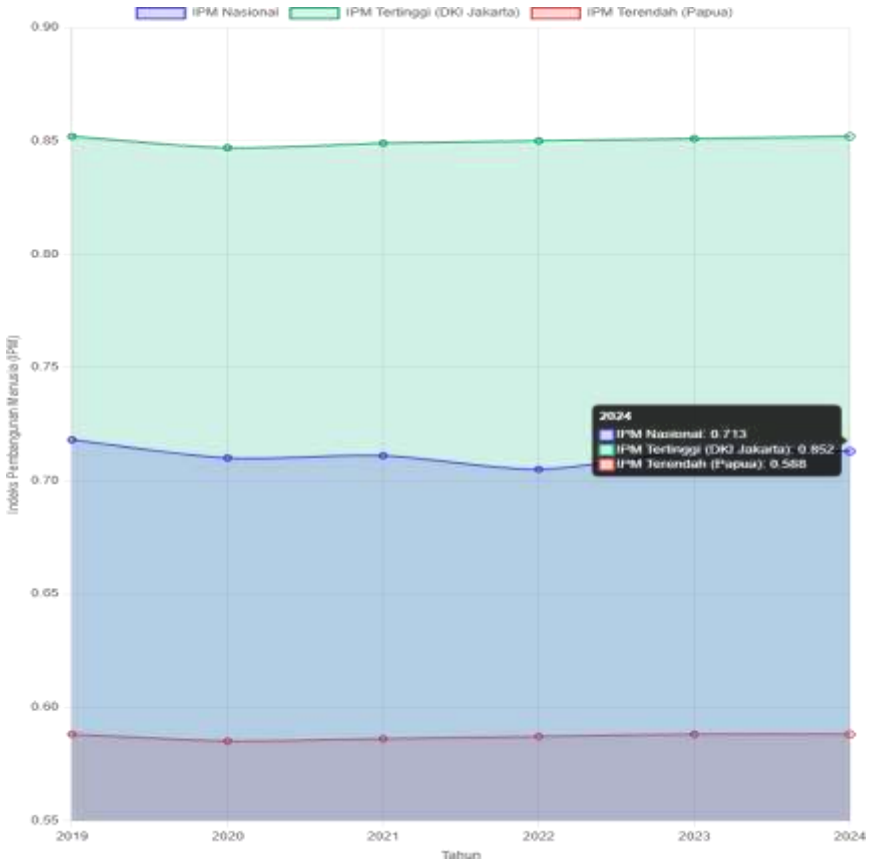

Figure 1. Development of Indonesia's Human Development Index (HDI) 2019-2024
Source: (BPS, 2025)

Based on the first graph, it can be seen that Indonesia's national Human Development Index (HDI) shows small variations but has tended to increase over the past five years. DKI Jakarta continues

to be the province with the highest HDI, reflecting better quality of life, education, and health compared to other provinces. On the other hand, Papua is still at the bottom, indicating serious challenges in equitable human development. This disparity underscores the importance of affirmative policies focused on enhancing human resources in underdeveloped regions to prevent them from falling further behind economic growth centers. The increase in the national HDI after 2022 also reflects the positive impact of various government programs in education, health, and the economy, though efforts to achieve equity must continue to be strengthened (UNDP, 2023).

The correlation between increases in the Human Development Index (HDI) and the Micro, Small, and Medium Enterprises (MSME) Index (IMDI) and the performance of MSMEs is evident from the national MSME business index data released by Statista and the Central Statistics Agency (BPS). In the third quarter of 2024, Indonesia's MSME business index recorded a value of 102.6, indicating an expansion phase, despite a decline from 109.9 in the previous quarter. Nevertheless, this figure remains above the optimism threshold (>100) (Tjahjadi et al., 2022). The SME business index is calculated based on several factors such as production volume, sales value, average selling price, inventory levels, number of employees, and investment. This reflects the actual dynamics of the SME sector's performance, which serves as the backbone of the national economy (Syariati, 2022). The continuous increase in the SME business index over the past two years is closely tied to the role of digitalization in expanding market access, improving operational efficiency, and accelerating product and service innovation. All of this depends heavily on the quality of human resources and digital literacy levels in each region (Kádárová et al., 2023). However, if one element such as digital literacy or human resource quality is inadequate, the use of digital technology will not function optimally (Setyadi et al., 2025). Regions with high HDI and IMDI, such as Jakarta and Yogyakarta, consistently record SME business indices above 108, indicating expansion and optimism among business operators. Conversely, provinces with low HDI and IMDI, such as Papua and NTT, remain at a business index level below 95, indicating stagnation or even decline in the SME sector, thereby increasing the risk of business failure and widening the economic gap at the national level (Syariati, 2022).

Figure 2. Indonesian MSME Business Index Q3 2023 – Q3 2024
Source: (BRI, 2025)

Based on graph 2, it can be seen that the MSME business index in Indonesia showed an increase from the third quarter of 2023 to the first quarter of 2024, reaching a high point of 109.9.

However, after that, there was a gradual decline until the third quarter of 2024, although the index remained above 100, indicating expansion in business. These changes reflect the dynamics of the economy at both the national and global levels, including the effects of post-pandemic recovery and external challenges such as global inflation and changes in market demand. The data also indicates that despite the pressures, the SME sector has been able to withstand and adapt, partly due to accelerated digitalization processes and strengthened human resource capabilities (Wang et al., 2024).

The digital transformation taking place in Indonesia's MSME sector is not only improving operational efficiency, but also expanding access to markets and alternative sources of financing (Maulana, 2025). The digitalization process enables SMEs to reduce their reliance on traditional banking systems and more easily access digital financial services, thereby strengthening business resilience and enhancing productivity (Maulana, 2025). Research involving more than 5,500 MSMEs in Indonesia shows that the adoption of the internet and digital technology in running a business significantly increases financial inclusion, expands investment opportunities, and accelerates the creation of new jobs (Maulana, 2025). However, not all regions experience these benefits equally, as there are still challenges such as low digital literacy rates, limited technological infrastructure, and suboptimal access to financing in underdeveloped areas (Raihan et al., 2025). Therefore, it is important to improve digital literacy and strengthen infrastructure so that all SME actors, both in urban and rural areas, can fully and sustainably benefit from digital transformation (Wang et al., 2024).

One element often overlooked in discussions about SME digitalization is the significance of collaboration between various sectors and regions. Experiences across provinces indicate that the success of SME digitalization depends not only on internal factors such as technological readiness and human resources but also on support from an external ecosystem involving local governments, educational institutions, the private sector, and local communities (Jaya et al., 2024). This collaboration accelerates knowledge exchange, expands access to digital resources, and strengthens business networks, thereby creating a significant multiplier effect on regional economic growth (Setyadi et al., 2025). Additionally, the presence of digital business incubators and innovation centers in several major cities has become a key driver in fostering technology-based startups and SMEs capable of competing at the global level (Vaza et al., 2024). The most important thing is to find ways to replicate this successful collaboration model in underdeveloped regions, so that the benefits of digitalization can be felt evenly across Indonesia.

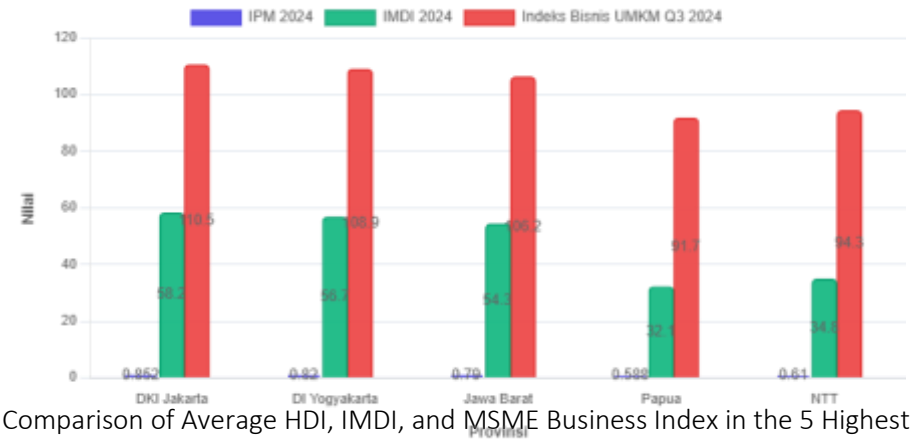

Figure 3. Comparison of Average HDI, IMDI, and MSME Business Index in the 5 Highest and Lowest Provinces in Indonesia in 2024

Source: (BPS, 2025) (KOMDIGI, 2024) (BRI, 2025)

Based on graph 3, it is clear that regions with high HDI and IMDI values, such as DKI Jakarta and DI Yogyakarta, also have much higher MSME business indices than regions with low HDI and IMDI values, such as Papua and NTT. This shows a strong relationship between the quality of human

development, digital capabilities, and the competitiveness of micro, small, and medium enterprises. The regional disparities highlighted in this graph underscore the importance of targeted policy interventions to accelerate the equitable distribution of human development and digitalization across Indonesia, ensuring that all SME actors can benefit from digital economic growth in a fair and equitable manner.

The increase in digitalization in the MSME sector has also driven rapid growth in e-commerce in Indonesia. Comprehensive research conducted by Silaban et al. (2024) show that the implementation of e-commerce has expanded the market reach of MSMEs, accelerated business processes, and improved operational performance (Silaban et al., 2024). E-commerce provides SMEs with the opportunity to reach consumers beyond traditional geographical boundaries, even extending to global markets, thereby opening up more opportunities for increased revenue (Deku et al., 2024). However, issues such as low digital literacy, inadequate technological infrastructure, and limited access to digital financing remain major obstacles, particularly for SMEs in remote and rural areas. Therefore, collaboration between the government, private sector, and educational institutions is essential to create digital literacy training programs, improve access to infrastructure, and build an inclusive and sustainable digital business ecosystem.

In addition to market and financial elements, digital transformation also plays a vital role in improving the productivity and competitiveness of micro, small, and medium enterprises (MSMEs). Research by Supari and Anton (2022) reveals that digitization significantly stimulates an increase in MSME income and profits (Supari & Anton, 2022). The use of digital technology in inventory management, promotion, and customer service has proven to reduce operational costs, accelerate production, and improve service quality. MSMEs that can effectively utilize digital technology are more resilient in facing market changes and economic crises, as seen during the COVID-19 pandemic(Supari & Anton, 2022). However, to achieve optimal benefits from digitalization, improving the quality of human resources through education, training, and continuous mentoring is essential, enabling SME operators to continue innovating and adapting to global market developments.

The role of the government is crucial in accelerating digital transformation in the SME sector. Policies supporting the development of digital infrastructure, tax incentives for technology investments, and digital training and mentoring programs are key factors in creating an inclusive and competitive SME ecosystem (Zhang et al., 2022). Data from the Central Statistics Agency (BPS) and the Ministry of Communication and Information Technology indicate that regions with strong digital policy support tend to experience higher growth in SME business indices compared to other regions (Tambunan & Busnetti, 2024). Additionally, it is necessary to continue strengthening the integration between human development programs and community digitalization so that all SME actors can benefit fairly and sustainably from digital transformation. Thus, collaboration between human development, digital literacy enhancement, and policy support will form the foundation for improving the competitiveness of Indonesian SMEs in the digital economy era.

Amid dynamic global changes and complex domestic challenges, it is crucial to emphasize that the success of SME digitalization is greatly influenced by mental readiness and a culture of innovation at the local level. Many SME operators still face psychological barriers when adopting new technologies, such as fear of failure, limited digital knowledge, and a lack of successful examples in their surroundings. Therefore, in addition to intervention policies and infrastructure improvements, a community-based approach focused on empowerment, support, and the creation of a collective learning ecosystem is needed. Mentoring programs, business incubation, and creative digital communities can be effective solutions in building confidence, accelerating knowledge exchange, and enhancing innovation among SME actors. By prioritizing cross-sector collaboration and participatory approaches, Indonesia can ensure that digital transformation is not just an elite agenda but a national movement that is inclusive and has a broad impact on the entire community.

LITERATURE REVIEW AND HYPOTHESIS FORMULATION

The use of online platforms such as Shopee, Tokopedia, and Instagram Shop has had a significant positive impact on the performance of MSME businesses. A report from INDEF titled "The Role of Digital Platforms in the Development of SMEs in Indonesia" (January 2024) states that approximately 50% of SME respondents in the Jabodetabek area and regions outside Java have utilized e-commerce, with 88% of them achieving an increase in annual turnover and 66% reporting income growth of over 50% after transitioning to digital platforms (Amali et al., 2025). The use of digital platforms demonstrates high value in the Indonesian Digital Society Index (IMDI) in these regions, directly increasing the number of workers and operational efficiency. This proves that the IMDI has a positive impact on the SME Business Index by expanding market access and enhancing business capacity through digital technology. The implementation of e-commerce training programs such as Shopee's SME Campus and Lazada University, known to 34.65% of SMEs highlights the importance of digital literacy in increasing platform usage. All these findings further emphasize that the higher the IMDI value, the more the SME Business Index will improve in addressing modern market challenges (Handoyo et al., 2020).

The quality of the workforce has proven to be a key element in maximizing the use of digital technology. Siminto (2024), through a systematic review of 147 studies, found that human resource capabilities including financial and business understanding increase the capacity of MSMEs to adopt and implement digital technology (Siminto, 2024). A high Human Development Index indicates workforce capabilities in education and health, which in turn enhance the effectiveness of the Digital Management Index through readiness in technology implementation. This correlation is evident in SMEs that have access to digital platforms but lack skilled human resources; their business performance remains lagging. On the other hand, in regions with a high Human Development Index, the use of digital platforms is more efficient with clear product innovations and business strategies. The logical consequence is that an increase in the Human Development Index can drive the growth of the SME Business Index, especially if accompanied by a simultaneous increase in the Digital Management Index.

Collaboration between the government, educational institutions, and the private sector plays an important role in strengthening the impact of digitalization. Balzano et al. (2025) argue that in regions with strong inter-institutional collaboration, SMEs have proven to be more resilient and capable of withstanding economic shocks (Balzano et al., 2025). While the IMDI does provide digital infrastructure and access to technology, without institutional support and improvements in human capital quality (HDI), the full potential of digitalization cannot be realized. When digital platforms are accompanied by training, tax incentives, and inter-institutional partnerships, the SME business index shows more stable and significant growth. This demonstrates that enhancing IMDI has a positive effect on the SME business index, but this effect only occurs consistently if HRQ is also strengthened through cross-sectoral interventions.

Human resource readiness and funding are key factors in determining the effectiveness of digital transformation. Research by Chusuma (2024) involving 100 MSMEs found that the main obstacles were low digital skills and limited access to capital, which can be overcome by collaborating with educational institutions or digital training institutions (Chusuma, 2024). This situation indicates that the Human Development Index (HDI) reflects human resource capabilities, while the Indonesian Digital Society Index (IMDI) measures access to technology and digital financing methods. The imbalance between these two aspects hinders the development of SME business indices, even in terms of digital platform usage. Combining trained human resources with access to digital capital can optimize IMDI potential, thereby enhancing SME performance and sustainability.

In the realm of product development and marketing tactics, human resource capabilities play a crucial role in transforming the use of digital technology into tangible business results. Research by Bhatti et al. (2022) indicates that micro, small, and medium-sized enterprises (MSMEs) with internal innovation capabilities can optimize the use of digital platforms more effectively:

achieving cost savings, product diversification, and more efficient supply chain management systems (Bhatti et al., 2022). A high Human Development Index through education and a focus on entrepreneurship drives innovation, while the Indonesian Digital Society Index provides the necessary technological foundation. The combination of the HDI and IMDI creates a competitive digital ecosystem and elevates the business performance index of MSMEs to a higher level compared to relying on either element alone.

Hypothesis Formulation

H1: An increase in IMDI has a positive effect on the MSME business index in Indonesia.
H2: An increase in HDI has a positive effect on the MSME business index in Indonesia.
H3: Increased HDI and IMDI together synergistically increase the MSME business index, so that regions with high HDI and IMDI show a superior MSME business index.

RESEARCH METHODS

This research applies quantitative methods with multiple linear regression to evaluate the impact of two main variables, namely the Indonesian Digital Society Index (IMDI) and the Human Development Index (HDI), on the MSME Business Index in 38 provinces in Indonesia from 2022 to 2024. The quantitative method was chosen because it can objectively measure the relationship between variables by utilizing numerical data processed through statistical methods (Lee et al., 2019).

The data used in this study is taken from official publications issued by the Central Bureau of Statistics (BPS) and the Ministry of Communication and Information. Before conducting regression estimation, the model will be analyzed through classical assumption tests to ensure the validity of the model, as well as through statistical hypothesis testing to evaluate the significance of the influence between variables. In this study, the independent variables consist of IMDI value (X_1) and HDI value (X_2), while the dependent variable is the MSME Business Index (Y). The multiple linear regression model applied in this study can be formulated as follows:

$$Y=\alpha+\beta1X1+\beta2X2+\varepsilon$$

Description:

Y : MSME Business Index
α : Regression constant
β1 : IMDI regression coefficient
β2 : HDI regression coefficient
X1 : IMDI value (Indonesian Digital Society Index)
X2 : HDI value (Human Development Index)
E : Error term

This model aims to identify the contribution of digitalization and the quality of human resources to strengthening the competitiveness and sustainability of MSMEs in the digital economy era.

RESULTS AND DISCUSSION

1. Classical Assumption Test
   Classical assumption testing aims to ensure that the linear regression model created meets certain statistical criteria so that the estimates obtained are valid, unbiased, and efficient. In this analysis, a series of tests are carried out on several basic regression assumptions, which include normality of data distribution, absence of multicollinearity between independent variables, uniformity of error variance (homoscedasticity), and no autocorrelation in residuals. The following are the results of the classical assumption test that has been carried out.

Table 1. Normality Test

	Test Item	Unstandardized Residual	
	N	87	
	Normal Parameters	Mean	,00000000
		Std. Deviation	2,00877592
	Most Extreme Differences	Absolute	,039
		Positive	,039
		Negative	-,038
	Test Statistic		,039
	Asymp. Sig. (2-tailed)		,200[c.d]

Source: Data Processed, 2025

Asymp. Sig. (2-tailed) of 0.200 is greater than the significance limit of 0.05. This shows that the residuals are normally distributed, so the assumption of normality in regression analysis has been met.

Table 2. Multicollinearity Test

Model	Collinearity Statistics Tolerance	Collinearity Statistics VIF
(Constant)		
X1_IMDI	0.240	4.159
X2_IPM	0.240	4.159

Source: Data Processed, 2025

The tolerance value of 0.240 is above the minimum limit of 0.1, which means that each independent variable does not have a high correlation with other variables. In addition, the VIF value of 4.159 is still below the maximum limit of 10, so it does not indicate any disturbing multicollinearity. Thus, the regression model fulfills the multicollinearity-free assumption.

Table 3. Heteroscedasticity Test

Model	Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
(Constant)	6.275	1.922		3.265	.002
X1_IMDI	0.027	0.040	0.143	0.669	.505
X2_IPM	-0.081	0.045	-0.388	-1.811	.074

Dependent variables: Abs_Res

Source: Data Processed, 2025

The heteroscedasticity test was conducted using the Glejser approach, which means correlating the absolute residual values with the independent variables. The results show that the significance level for X1_IMDI is 0.505 and for X2_IPM is 0.074, both of which exceed 0.05. This indicates that there is no significant relationship between the absolute residual values and the independent variables. Therefore, it can be concluded that the regression model shows no heteroscedasticity problem and passes the heteroscedasticity test.

Table 4. Autocorrelation Test

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	0.713	0.508	0.497	2.03255	1.804

Source: Data Processed, 2025

The autocorrelation test is performed using the Durbin-Watson (DW) value to see if there is a correlation between the residuals in the regression model. With the number of observations (n) of 114 and the number of independent variables (k) of 2, the lower limit value (DU) is 1.715 and the upper limit is 4 - DU = 2.285. Because the DW value of 1.804 is between 1.715 < 1.804 < 2.285, it meets the DU < DW < 4 - DU criteria. Thus, it can be concluded that the regression model does not contain autocorrelation symptoms, and passes the autocorrelation test.

2. Uji Hipotesis Statistik

Multiple linear regression analysis is used to determine the effect of two independent variables, namely the Indonesian Digital Society Index and the Human Development Index on the MSME Business Index as the dependent variable.

Tabel 5. Regression Analysis Results

Model	Unstandardized Coefficients B / Std. Error	Standardized Coefficients Beta	t	Sig.
(Constant)	135.338 / 3.206		42.213	.000
X1_IMDI	0.287 / 0.067	0.670	4.297	.000
X2_IPM	-0.584 / 0.075	-1.217	-7.800	.000

Dependent variables: Y_Indeks Bisnis UMKM

Source: Data Processed, 2025

Based on the results of multiple linear regression analysis, the model equation is obtained:

Y = 135.338 + 0.287IMDI - 0.584IPM

The result of the F test shows a significance figure of 0.000, which is far below the significance level of 0.05. This indicates that IMDI and HDI variables simultaneously affect the MSME Business Index. Since the F test shows significant results, hypothesis H3 is accepted. Therefore, it can be concluded that increasing community digitization and human development simultaneously contribute positively to strengthening the MSME business index, indicating an important synergistic relationship in the context of regional development focused on digital inclusion and transformation.

Partially, IMDI has a positive and significant influence on the MSME Business Index. The regression coefficient value of 0.287 and significance of 0.000 <0.05 indicate that hypothesis H1 is accepted. This means that the higher the level of community digitization, the greater the contribution to the growth and strengthening of the MSME sector in Indonesia.

In contrast, HDI shows a significant negative effect on the MSME Business Index, with a coefficient of -0.584 and a significance of 0.000 < 0.05. Thus, hypothesis H2 is rejected as the direction of the effect is not as expected. However, this rejection does not mean that HDI is not important; quite the contrary, it shows the complexity of the relationship between human development and the MSME sector. Regions with high HDI may have socio-economic characteristics that make MSMEs have to compete in a more competitive, capital-intensive, or formal sector-focused ecosystem, thus negatively impacting the MSME business index. In contrast, in areas with low HDI, the business environment tends to be more open and

dominated by the informal sector, so MSMEs have more room to grow even though the quality of human development is not optimal.

Table 6. R-square Analysis Results

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.713	0.508	0.497	2.03255

Source: Data Processed, 2025

Based on the available data, the R-Squared value of 0.508 indicates that 50.8% of the variation in the MSME Business Index can be explained by the two independent variables contained in the model, namely the Indonesian Digital Society Index (IMDI) and the Human Development Index (HDI). This means that the contribution of these two variables to changes in the value of the MSME business index amounts to more than half of the total variation. Meanwhile, the remaining 49.2% of the variation is explained by other factors outside the regression model used in this study.

3. Discussion

3.1 Effect of IMDI on MSME Business Index

Increasing the value of the Indonesian Digital Society Index (IMDI) has a direct positive impact on the productivity and competitiveness of the MSME sector by opening access to digital markets, expanding the consumer base, and increasing efficiency in the supply chain through the use of technology (Wulandari et al., 2024). Research by Yuwono et al. (2024) indicates that digital inclusion is a major factor in the development of MSMEs in developing countries, where the use of digital technology generates new economic opportunities for small businesses (Yuwono et al., 2024). Similar findings were also found in the research of Sun & Zhang (2024) which shows that digitalization in micro-enterprises consistently increases production capabilities and flexibility in the face of changing market needs (Sun & Zhang, 2024). This beneficial effect on business performance comes from the increased ability of MSME players to utilize digital platforms for promotion, payment, and customer management activities. In the digital economy, technology utilization serves as a driver of productivity and a link between small businesses and international markets. This research shows that IMDI contributes positively to the improvement of the MSME Business Index, as individuals who are more familiar with digital technology tend to adopt innovations faster, improve business efficiency, and expand cooperation among MSME actors. The emerging digital environment also mobilizes the participation of various parties-including technology providers, digital financial institutions, and local governments-in strengthening the sustainability of digital-based small businesses.

Improving digital literacy skills among the public also increases the effectiveness of digitalization programs for MSMEs run by the government and the private sector. If MSME players have adequate digital knowledge, the process of accepting technology will run more easily and the results will have more impact on business sustainability. IMDI here not only assesses digital infrastructure, but also the social and cultural readiness of a region in facing digital transformation. With the increasing value of IMDI, cooperation between MSMEs, digital service providers, and technology financial institutions becomes easier to materialize. This accelerates the integration of MSMEs in the national digital ecosystem and opens up opportunities for access to international markets. Therefore, strengthening IMDI should be the main focus of regional economic development policies that emphasize MSME empowerment. Comprehensive digital transformation not only creates efficiency in organizations, but also strengthens the bargaining position of MSMEs in the digital market. In addition to technological factors,

IMDI advancements also contribute to increased digital financial inclusion among micro, small, and medium enterprises. Entrepreneurs who embrace digitalization often have easier access to technology-based financial services such as online lending, digital wallets, and fundraising platforms. This access is critical, especially for MSMEs located in remote areas with limited access to the traditional banking system. With the increase in IMDI, opportunities to obtain financing, take part in online training, and use app-based management systems have become more widespread. This reduces the gap between micro and medium enterprises in less developed areas and those in more developed areas. Therefore, IMDI is not just a measure of digitalization, but also a strategic tool to promote economic equality through strengthening digitally-based MSMEs.

3.2 Effect of HDI on MSME Business Index

An increase in the Human Development Index (HDI) indicates progress in education, health, and income, which should increase the ability of human resources to engage in productive economic activities, including in the micro, small, and medium enterprise (MSME) sector (Xholo et al., 2025). Research by Hossain et al. (2024) revealed that improving human quality has a positive impact on the readiness of the workforce to adopt technology and start their own businesses (Hossain et al., 2024). However, in the context of MSMEs in Indonesia, the results of this study actually show a significant negative effect of HDI on the MSME Business Index. This finding is consistent with the results of Ratnaningtyas et al. (2025) who found that regions with high HDI tend to have a more formal and competitive economic structure, so MSMEs face greater challenges in running their operations (Ratnaningtyas et al., 2025). In such situations, small entrepreneurs are faced with strict regulations, high expectations from consumers, and competition from medium to large businesses. Therefore, despite improvements in human capital quality, without support for MSMEs through incentives, entrepreneurial training, and access to markets and capital, the contribution of HDI to MSME performance will not be maximized. This research emphasizes the importance of inclusive public policies to ensure that improvements in HDI can serve as a real driver for the strengthening of small business-based local economies.

This unfortunate phenomenon can be deciphered through the shift in employment choices that occurs in areas with a high Human Development Index (HDI). Residents in these areas are more likely to opt for formal jobs that offer a steady income and more secure social security, which may reduce the interest in starting a small business. This results in the Micro, Small and Medium Enterprises (MSME) sector lacking new qualified actors, as many human resources shift to large private companies or government agencies. On the other hand, there is also greater consumer demand in areas with high HDI, which requires MSMEs to achieve more professional standards of products and services. However, not all MSMEs have sufficient resources to meet these challenges. As a result, while in theory, rising HDI may provide economic benefits, in practice it may create structural constraints for micro and small business actors. Therefore, an increase in HDI needs to be accompanied by affirmative strategies that support MSMEs to remain competitive in an evolving society. In addition to competition, a high Human Development Index is often accompanied by an increase in the cost of living and business operations, which has a direct impact on the viability of MSMEs. The cost of renting business premises, minimum wages, and expensive raw materials in areas with a high HDI become an additional burden for MSME players with limited capital. Under these circumstances, it is difficult for MSMEs to compete without policy support such as subsidies, business training, or more flexible access to microcredit. Without such interventions, the huge potential of high human capital quality will be wasted, and the growth of MSMEs will be uneven. Therefore, human development must be aligned with local economic strengthening strategies, so that qualified human resources are not only

workers, but also job creators. The combination of improving HDI and a supportive MSME ecosystem is key to driving sustainable and inclusive regional economic growth.

CONCLUSION

The increase in Indonesia's Digital Society Index (IMDI) and Human Development Index (HDI) together have a positive impact on strengthening the MSME business index, suggesting a crucial synergistic relationship in digital inclusion and transformation-oriented regional development. This research reveals that IMDI significantly affects the MSME Business Index in a positive way, meaning that increased digitization among the public will accelerate the growth and strengthening of the MSME sector in Indonesia. MSMEs that utilize digital technology are able to expand their market reach, improve efficiency in operations, and access financing sources that are not from traditional channels, which in turn can strengthen the resilience of their businesses. However, this study also shows that HDI separately has a significant negative influence on the MSME Business Index. This may be due to intensified competition, increased operational costs, and the tendency of labor to prefer the formal sector in areas with high HDI, which may limit opportunities for MSMEs.

The findings emphasize the importance of inclusive public policies so that progress in the Human Development Index (HDI) truly supports the strengthening of regional economies driven by Micro, Small and Medium Enterprises (MSMEs). Measures focusing on digital training, provision of technology infrastructure, and easy access to funding sources, especially in areas with low HDI and Indonesia Digital Mobility Index (IMDI), are necessary to address gaps in digital access and the economy. Cooperation between the government, businesses, and educational institutions is necessary to build a supportive digital ecosystem for MSMEs, which in turn will accelerate sustainable and inclusive economic growth across the country. Therefore, the success of the MSME digitization process depends not only on technological aspects, but also on the readiness of human capital and the existence of a collaborative environment that supports innovation.

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