International Journal of Accounting and Economics Studies, 12 (7) (2025) 788-796

International Journal of Accounting and Economics Studies

Website: www.sciencepubco.com/index.php/IJAES
https://doi.org/10.14419/1f3qyd44
Research paper

Digitalization and Green Innovation on MSME Performance with Government Policy as A Moderator

Wati Aris Astuti [1] *, Dony Waluya [1], Eko Mayndarto [2], Endro Andayani [3]

[1] Universitas Komputer Indonesia (UNIKOM), Indonesia
[2] Universitas Tama Jagakarsa, Indonesia
[3] Institut Ilmu Sosial dan Manajemen STIAMI, Indonesia
**Corresponding author E-mail: wati.aris.astuti@email.unikom.ac.id*

Received: September 30, 2025, Accepted: November 19, 2025, Published: November 28, 2025

Abstract

This study aims to analyze the impact of digitalization, green innovation, and tax incentives on MSME performance with government policy as a moderating variable. Digitalization is expected to improve operational efficiency, green innovation supports the development of environmentally friendly products, and tax incentives provide financial encouragement for MSMEs to transform toward sustainable business practices. This research uses primary data obtained through questionnaire distribution to MSME actors in Jakarta and Bogor. The sample size was determined using Hair et al.'s (2022) approach. Data analysis was conducted using the Structural Equation Modeling–Partial Least Squares (SEM-PLS) method to test both direct effects and the moderating role of government policy. Research results show that only the green product innovation variable has a significant impact on MSME performance. Meanwhile, digitalization and tax incentives do not provide meaningful effects on MSME performance improvement. Furthermore, government policy is also not proven capable of moderating the relationship between independent variables and MSME performance. These findings confirm that green product innovation is a key factor in driving MSME performance, while support from digitalization, tax incentives, and the role of government policy have not yet provided the real impact as expected.

Keywords: *Digitalization; Green Innovation; Tax Incentives; Government Policy; MSME Performance.*

1. Introduction

Digital transformation has now become a primary factor in enhancing organizational competitiveness in the Industry 4.0 era. The implementation of digital technology provides opportunities for companies to optimize operational efficiency, encourage innovation, and strengthen data-based decision-making. [1]. The presence of integrated information systems also has a strategic role in supporting more effective data management, accelerating business processes, and improving organizational capability in responding to market changes. [2]. Hence, understanding the interconnection among digital technology adoption, information system integration, and organizational performance is becoming increasingly important, both in academic and managerial practice contexts.

Several previous studies show that digital technology adoption positively affects work efficiency and organizational innovation. [3]. Yet, the benefits of digitalization cannot be fully optimized without adequate information system integration. [4]. In fact, organizations with fragmented information systems often experience difficulties in managing data and face obstacles in strategic decision-making. [5]. This condition ultimately directly impacts organizational performance decline.

Nonetheless, digital transformation implementation is also inseparable from challenges, such as internal resistance, infrastructure limitations, and digital skill gaps among employees. [6]. If not properly addressed, these obstacles can potentially reduce digitalization effectiveness and diminish its contribution to organizational performance improvement. Yet, digital technology utilization has great potential in encouraging green innovation products, namely the development of environmentally friendly products that not only focus on resource efficiency but are also capable of strengthening competitiveness and organizational performance. [7], [8].

The concept of green innovation itself is an important part of sustainable business strategy that emphasizes efforts to create products and processes with lower environmental impact. [9]. Various studies state that investment in green innovation can open new market opportunities, increase competitive advantage, and improve organizational performance. [7]. Additionally, green innovation also encourages company awareness to produce products free from harmful or toxic materials. [10], making it an important element in realizing sustainable development [11]. Interestingly, innovation is not only relevant for large companies but can also be implemented by MSMEs on a simpler scale. [12], [13].

Although MSMEs are often considered to have low awareness of green innovation, this sector has proven to be resilient in facing crises. For example, in 2023, the Indonesian economy grew by 4.64%, while MSMEs contributed around 61% to the GDP and absorbed more than 97% of the workforce (Ministry of Cooperatives and MSMEs, 2023; BPS, 2023). Despite experiencing growth, Indonesia's manufacturing sector still faces several major challenges. One main challenge is poor infrastructure, a key example being the lack of

integrated industrial areas and suboptimal logistics systems. Additionally, global supply chain disruptions have become a significant problem. Geopolitical instability and climate change cause price fluctuations, supply delays, and increased logistics costs.
Another challenge is Human Resources (HR) limitations. Currently, there is a skilled labor crisis, where demand for specific expertise is higher than its availability. This impacts manufacturing industry efficiency and productivity. Raw material price fluctuations also put great pressure on the manufacturing industry. Increasing input costs can reduce profit margins and hinder business growth. Furthermore, low innovation levels in the manufacturing sector are also challenging, as a lack of technology adoption and innovative strategies can hinder industry competitiveness.
The Indonesian government, through the 2025 State Budget (APBN), has established the theme 'Acceleration of Inclusive and Sustainable Economic Growth', with budget allocation to support MSME digitalization, human resource development, infrastructure, and green industry (Ministry of Finance of the Republic of Indonesia, 2025). In addition, the Indonesia Digital Transformation Roadmap 2025–2045 emphasizes the expansion of digital access, improvement of digital literacy, development of digital talent, as well as promoting digitalization of productive sectors and the green economy (Ministry of Communication and Informatics of the Republic of Indonesia, 2024).
To address these challenges, the government has implemented various strategic policies. One step taken is infrastructure improvement by building industrial areas, ports, and highways. Additionally, the government is also developing Special Economic Zones (SEZs) and Industrial Parks and optimizing logistics systems to facilitate exports and imports. On the fiscal side, the government provides tax incentives for companies investing in technology and supports export-oriented companies through fiscal incentives. Another step taken is increasing trade support through free trade agreements (FTA), export promotion, and cooperation with international institutions to overcome tariff and non-tariff barriers.
In the labor aspect, the government strives to improve workforce skills and productivity through training and education. [14,15]. Additionally, incentives are provided to workers participating in skill development programs. Support for innovation is also a priority, by encouraging the processing and refining of raw materials domestically and aligning regulations and policies to increase industry productivity. Furthermore, the government provides financial support for SMEs to invest in digital technology, and eases Loan to Value (LTV) regulations and down payment policies to support business expansion.
Based on this description, research on the Role of Digitalization and Green Innovation on Organizational Performance with Government Policy as Moderator becomes relevant to conduct. It is envisaged that this research will provide a clearer picture of how digitalization and green innovation shape MSME performance, while assessing the extent to which government policy can strengthen this relationship to encourage competitiveness in the digital economy era and sustainable development. In light of the foregoing, the present study elucidates the impact of tax incentives on organizational performance, the contribution of green product innovation in improving performance, the role of digital technology in supporting organizational performance, and the function of government policy as a moderating variable in the interconnection among these variables.

2. Literature Review

2.1. Digital technology

The definition of digitalization itself is the increasing availability of digital data enabled by advances in creating, transferring, storing, and analyzing digital data, thereby paving the way for "structuring, shaping, and influencing the contemporary world." [16]. Correspondingly, Parida et al. [17] Posits that digitalization is defined as "the use of digital technology to innovate business models and provide new revenue streams and opportunities that generate value in industry ecosystems". The priority, therefore, is not the creation of new technology but a deeper comprehension of its practical deployment and use within a digital framework. [18].
The adoption of digital tools has a significant impact on both business and society in the digital era. Digital technology implementation can improve efficiency, organize business processes more systematically, and provide optimal customer experiences. Companies capable of adopting digital technology appropriately will gain a competitive advantage and be more adaptive to changing market needs. Additionally, digital technology implementation also supports environmental footprint reduction through remote work implementation, paperless systems, and more environmentally friendly business practices. Thus, digital technology utilization not only contributes to profitability improvement but also encourages future sustainability. [19].
Furthermore, system integration becomes an important factor in supporting digital transformation success. Through system integration, companies can obtain better visibility and control over the supply chain, thus improving response capability to market dynamics and consumer demand. Logistics management also becomes more efficient because system integration enables companies to reduce operational costs while optimizing performance. Moreover, real-time monitoring enabled by system integration helps management make quick and accurate decisions. Therefore, system integration can be viewed as an important strategy for companies in strengthening competitiveness in the digital era. [20].

2.2. Green product innovation

Green Product Innovation is an innovative strategy that not only considers environmental aspects but also focuses on improving the efficiency of raw material and energy use. Companies that do not integrate green product innovation into their business strategy risk falling behind in market competition. In line with this, various studies show that companies capable of adapting to climate change tend to be more prepared in maintaining profitability and sustainability.
Globally, the digital ecosystem continues to develop, fundamentally changing the meaning of value-added creation. Digital transformation serves as a cornerstone in reforming the manufacturing sector, particularly powered by technologies like Internet of Things (IoT), Artificial Intelligence (AI), and cloud computing that drive efficiency, automation, and business process flexibility. Companies adopting these technologies are proven to be more competitive and efficient. In the globalization era, technology and information development are increasingly rapid, reflected in the increasing number of social media users each year, without age or profession boundaries. Environmentally friendly product innovation is proven to provide a beneficial and influential impact on increasing taxpayer awareness. This makes green product innovation an important focus in facing environmental and sustainability challenges in the modern era. Additionally, this innovation creates economic opportunities, for example, through opening new job opportunities in the clean energy sector. Government regulatory support, fiscal incentives, and cross-sector collaboration are key factors in accelerating environmentally friendly product technology adoption.

In the Indonesian context, the manufacturing sector is the government's main focus, considering its contribution to exports, GDP, and employment. The implementation of environmentally friendly product innovation is proven capable of improving organizational performance, particularly MSMEs, while strengthening competitiveness and response to consumer trends and preferences that increasingly emphasize sustainability aspects.

Recent studies in Indonesia show that the integration between green innovation and digital transformation serves as a cornerstone for improving the performance and sustainability of MSMEs. Ginting & Rijal [21] Found that environmental innovation, access to financing, and corporate governance significantly influence the financial sustainability of MSMEs in Indonesia, confirming that environmentally friendly practices are a key strategy in facing market and regulatory pressures. Anatan & Nur [22] Highlighted the readiness of Indonesian MSMEs in facing the digitalization era and Industrial Revolution 4.0, with results showing that digital adaptation capability determines the level of productivity and operational efficiency of small business actors. Furthermore, Mentari et al. [23] Demonstrated that the synergy between green innovation and digital transformation can simultaneously improve MSME performance, particularly in the manufacturing and creative sectors. Panuju & Bakri [24] Empirical literature analysis also underlined that the implementation of green innovation not only contributes to environmental preservation but also enhances business reputation and competitiveness. Meanwhile, Sisca & Wijaya [25] Proved that green innovation has a major beneficial force on the sustainable business performance of MSMEs in the food and beverage sector in Indonesia. Thus, these research findings confirm that collaboration between green innovation and digitalization becomes the main driver in strengthening the competitiveness and sustainability of Indonesian MSMEs amid modern economic dynamics.

2.3. Organizational performance

Organizational performance is a measure of effectiveness and efficiency in achieving strategic goals. In the context of digital transformation, organizational performance can be measured through financial, operational, innovation, and customer satisfaction aspects. [1]. Performance is a process used by leaders to determine whether an employee performs work according to their duties and responsibilities or not, so that the steps used to represent performance are chosen based on the condition of the organization being observed. This research refers to Kaplan & Norton. [26] A concept that introduced the balanced scorecard, emphasizing that all financial and non-financial measures become part of the information system for workers at all levels in the organization/company. The balanced scorecard is composed of four balanced perspectives, namely: 1) financial perspective, 2) customer perspective, 3) internal business process perspective, and 4) learning and growth process perspective.

2.4. Government policy

A clear and consistent regulatory framework is indeed essential in creating legal certainty for companies in developing environmentally friendly innovation. Porter and Linde [8] Emphasize that strict environmental regulations can encourage companies to innovate more efficiently, in line with the Porter Hypothesis.

Besides regulation, government support is also needed in the form of incentives, financing access, and research and development facilities. Horbach et al. [27] Found that public policy, both through regulatory push/pull and market pull, plays a significant role in encouraging green innovation. Thus, the existence of government policy can function as a moderating factor that strengthens the relation between digital technology adoption, green product innovation, and MSME sustainability.

3. Methodology

This research uses a quantitative approach, where the variables studied are measured with research instruments, resulting in numerical data that can be analyzed using predetermined statistical procedures. The quantitative approach was chosen because it enables researchers to test relationships between variables objectively and measurably. The research method used is a survey method, namely, data collection through questionnaire distribution to respondents relevant to the research objectives. [28].

The research population is Micro, Small, and Medium Enterprises (MSMEs) with approximately 1,000 units. Sample size determination refers to Hair & Alamer. [29] Guidelines, stating that the minimum sample size in Structural Equation Modeling (SEM) analysis is 5–10 times the number of estimated parameters, or 10 times the number of indicators in the research model. Based on the number of research indicators totaling 10, the minimum required sample is approximately 100 respondents. This sample size meets the necessary criteria for representativeness of the MSME population, while meeting representative criteria in SEM-based research. [29].

The study relied on nSmartPLS 4 software for the analytical framework, commonly used in Partial Least Squares Structural Equation Modeling (PLS-SEM) based research. Analysis stages include two main parts, namely: (1) measurement model evaluation (outer model), used to assess construct reliability and validity through Cronbach's Alpha, Composite Reliability, Average Variance Extracted (AVE), and discriminant validity tests; and (2) structural model evaluation (inner model), used to empirically examine the interrelationships among the studied factors. Significance testing was conducted with the bootstrapping technique, ensuring analysis results have adequate reliability and validity levels in supporting research conclusions. [29].

4. Results and Discussion

4.1. Results

This research examines the effect of Tax Incentives, Green Product Innovation, and Digital Technology on MSME Performance with Government Policy as a moderating variable. Analysis was conducted using PLS-SEM through SmartPLS 4 with a sample of 115 MSMEs drawn by purposive sampling. Data were acquired using online questionnaires and tested with bootstrapping of 5,000 resamples.

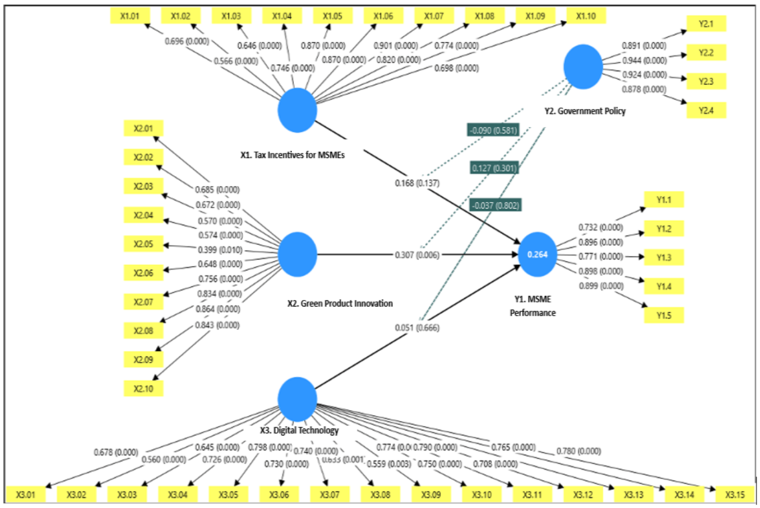

Fig. 1: Structural Model Diagram with Path Coefficients.

Figure 1 illustrates the structural model with standardized path coefficients obtained from PLS-SEM analysis. This model shows that Green Product Innovation has the strongest direct effect on MSME Performance (β = 0.307), followed by Tax Incentives (β = 0.168) and Digital Technology (β = 0.051). The R-square value of 0.264 demonstrates that an estimated 26.4% of the variance in MSME Performance is accounted for by three independent variables and their interaction with Government Policy. The coefficients visualized in Figure 1 also highlight that all hypothesized paths are positive, although only the Green Product Innovation → MSME Performance path is statistically significant. These results reinforce the conclusion that MSME performance improvement is primarily driven by environmental innovation factors rather than fiscal support or digitalization alone.

4.1.1. Measurement model testing results

The measurement model was evaluated to ensure indicator and construct reliability and validity, according to Hair et al. [30] Guidelines. Evaluation includes internal reliability, convergent validity, and discriminant validity. Measurement model evaluation results show that all constructs have Cronbach's Alpha and Composite Reliability values above 0.7, thus meeting internal reliability criteria. Average Variance Extracted (AVE) values mostly also exceed 0.5, confirming convergent validity fulfillment, although Green Product Innovation and Digital Technology constructs have AVE values slightly below 0.5 but remain acceptable due to high reliability. Thus, the measurement model is declared valid and reliable, making it suitable to proceed to the structural model evaluation stage. As shown in Table 1, all research constructs have met the reliability and validity criteria, so the measurement model can be considered valid and reliable for subsequent structural model analysis.

Table 1: Construct Reliability and Validity

	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted (AVE)
X1. Tax Incentives	0.920	0.947	0.933	0.586
X2. Green Product Innovation	0.885	0.921	0.901	0.488
X3. Digital Technology	0.932	0.957	0.939	0.509
Y1. MSME Performance	0.898	0.937	0.924	0.710
Y2. Government Policy	0.931	0.954	0.950	0.827

4.1.2. Construct reliability

Internal reliability was tested using Cronbach's Alpha and Composite Reliability (rho_a and rho_c). As evidenced by the test data, all constructs have Cronbach's Alpha values above 0.70, thus can be declared reliable. Composite Reliability values (rho_a and rho_c) are also consistently exceeding 0.70, strengthening the conclusion that constructs have good reliability. More specifically, Cronbach's Alpha values for Tax Incentives are 0.920, Green Product Innovation 0.885, Digital Technology 0.932, MSME Performance 0.898, and Government Policy 0.931. Meanwhile, Composite Reliability values are in the range of 0.901 to 0.950, confirming high construct reliability. The internal reliability and Composite Reliability results for all constructs are displayed in full in Table 1: Construct Reliability and Validity, which reinforces the conclusion that all constructs have good reliability.

4.1.3. Convergent validity

Convergent validity was evaluated using Average Variance Extracted (AVE) and outer loadings (cross loadings). Most constructs show AVE values above the 0.50 threshold, namely Tax Incentives (0.586), Digital Technology (0.509), MSME Performance (0.710), and Government Policy (0.827). This means the indicators used are capable of explaining construct variance well. However, Green Product Innovation has an AVE value of 0.488, slightly below the 0.50 threshold. Nevertheless, this value is still acceptable in exploratory research [31], although it indicates the need for indicator improvement in subsequent research. Cross-loading analysis results also show that each indicator has the highest loading on the measured construct, with most loading values above 0.70, thus supporting convergent validity. Based on reliability and validity test results, all constructs are declared to have high internal consistency and adequate validity. Hence, the measurement model is empirically sound for use in the structural model analysis stage. The details of AVE values and outer loadings for each construct can be seen in Table 1: Construct Reliability and Validity, which reinforces the conclusion that all constructs have met the convergent validity criteria, although Green Product Innovation has an AVE slightly below 0.50.

4.1.4. Discriminant validity

Discriminant validity was evaluated using the Fornell-Larcker Criterion and Heterotrait-Monotrait Ratio (HTMT).

Table 2: Fornell-Larcker Criterion

	X1.	X2.	X3.	Y1.	Y2.
X1. Tax Incentives	0.766				
X2. Green Product Innovation	0.472	0.698			
X3. Digital Technology	0.479	0.479	0.713		
Y1. MSME Performance	0.389	0.431	0.33	0.842	
Y2. Government Policy	0.246	0.375	0.287	0.271	0.91

Discriminant validity was assessed by means of the Fornell-Larcker Criterion and Heterotrait-Monotrait Ratio (HTMT). Testing results with the Fornell-Larcker Criterion show that the square root value of Average Variance Extracted (AVE) in each construct is higher than the correlations between other constructs. For example, the square root AVE value for Tax Incentives is 0.766, Green Product Innovation 0.698, Digital Technology 0.713, MSME Performance 0.842, and Government Policy 0.910. These values are larger than cross-correlations with other constructs; hence, this study establishes that each construct has good discriminant validity. Thus, these test results confirm that each variable in the research is capable of distinguishing itself from other variables, making it suitable for use in the structural model. The complete discriminant validity test results, including square root AVE values and correlations between constructs, are displayed in Table 2: Fornell-Larcker Criterion, which reinforces the conclusion that each construct is able to distinguish itself from other constructs.

Table 3: Heterotrait-Monotrait Ratio (HTMT) Values

	Heterotrait-monotrait ratio (HTMT)
X2. Green Product Innovation ↔ X1. Tax Incentives for MSMEs	0.499
X3. Digital Technology ↔ X1. Tax Incentives for MSMEs	0.497
X3. Digital Technology ↔ X2. Green Product Innovation	0.521
Y1. MSME Performance ↔ X1. Tax Incentives for MSMEs	0.373
Y1. MSME Performance ↔ X2. Green Product Innovation	0.416
Y1. MSME Performance ↔ X3. Digital Technology	0.303
Y2. Government Policy ↔ X1. Tax Incentives for MSMEs	0.276
Y2. Government Policy ↔ X2. Green Product Innovation	0.378
Y2. Government Policy ↔ X3. Digital Technology	0.283
Y2. Government Policy ↔ Y1. MSME Performance	0.281

Discriminant validity testing results using the Heterotrait-Monotrait Ratio (HTMT) uncover that all HTMT values are below the 0.90 threshold. The most pronounced relationship is evident between Digital Technology and Green Product Innovation (0.521), while the lowest value is in the relationship between Government Policy and MSME Performance (0.281). Thus, all constructs in this research can be clearly distinguished from each other, so discriminant validity is fulfilled, and the model is suitable to proceed to the structural analysis stage. The complete discriminant validity test results using HTMT and cross loadings are displayed in Table 3: Heterotrait-Monotrait Ratio (HTMT), which shows that all constructs can be clearly distinguished and each indicator reflects its construct well.

Cross-loading test results show that each indicator has the highest loading value on its measured construct compared to other constructs. For instance, all Tax Incentives indicators have the highest loading on the Tax Incentives construct; similarly, Green Product Innovation, Digital Technology, MSME Performance, and Government Policy indicators also show the same. This indicates that each indicator more strongly reflects its own construct compared to other constructs, thus convergent validity has been fulfilled. The complete cross-loadings test results are reflected in Table 4: Cross Loadings, which reveal a clear factor structure, with all indicators loading most highly on their own construct compared to other constructs; thus, convergent validity is fulfilled.

Table 4: Cross Loadings

	X1.	X2.	X3.	Y1.	Y2.	Y2. x X2.	Y2. x X1.	Y2. x X3.
X1.01	0.696	0.345	0.329	0.255	0.073	-0.113	-0.108	-0.169
X1.02	0.566	0.302	0.275	0.090	0.299	-0.047	0.047	0.005
X1.03	0.646	0.238	0.306	0.241	0.266	-0.025	-0.110	-0.033
X1.04	0.746	0.345	0.352	0.302	0.228	0.167	-0.037	0.033
X1.05	0.870	0.473	0.421	0.367	0.167	0.028	-0.121	-0.121
X1.06	0.870	0.381	0.416	0.337	0.137	0.014	-0.159	-0.126
X1.07	0.901	0.458	0.511	0.409	0.229	0.036	-0.159	-0.092
X1.08	0.820	0.371	0.279	0.360	0.186	-0.116	-0.242	-0.201
X1.09	0.774	0.278	0.436	0.225	0.251	-0.140	-0.212	-0.162
X1.10	0.698	0.391	0.311	0.180	0.197	-0.056	-0.121	-0.078
X2.01	0.324	0.685	0.344	0.248	0.138	-0.047	0.065	0.095
X2.02	0.355	0.672	0.365	0.227	0.293	-0.186	-0.109	0.003
X2.03	0.225	0.570	0.253	0.176	0.133	0.274	0.288	0.336
X2.04	0.236	0.574	0.256	0.204	-0.034	0.167	0.142	0.072
X2.05	0.091	0.399	0.258	0.010	0.083	0.234	0.350	0.193
X2.06	0.415	0.648	0.377	0.261	0.166	-0.046	-0.181	-0.071
X2.07	0.394	0.756	0.484	0.351	0.354	-0.245	-0.070	0.044
X2.08	0.356	0.834	0.311	0.454	0.337	-0.179	-0.045	-0.097
X2.09	0.387	0.864	0.404	0.402	0.455	-0.184	-0.018	-0.081
X2.10	0.372	0.843	0.336	0.333	0.371	-0.197	-0.041	-0.104
X3.01	0.364	0.519	0.678	0.333	0.353	-0.189	0.024	-0.005
X3.02	0.212	0.464	0.560	0.187	0.338	-0.202	0.040	-0.007
X3.03	0.258	0.215	0.645	0.125	0.032	0.158	0.171	0.111
X3.04	0.338	0.322	0.726	0.261	0.197	0.042	-0.122	-0.050
X3.05	0.415	0.356	0.798	0.395	0.249	0.032	-0.130	-0.048
X3.06	0.416	0.220	0.730	0.255	0.173	0.014	-0.145	-0.110
X3.07	0.412	0.247	0.740	0.166	0.248	-0.040	-0.195	-0.147

X3.08	0.322	0.331	0.633	0.090	0.143	-0.011	-0.173	-0.138
X3.09	0.217	0.216	0.559	0.123	0.135	0.027	-0.134	-0.103
X3.10	0.336	0.302	0.774	0.183	0.194	0.056	-0.137	-0.135
X3.11	0.279	0.324	0.750	0.182	0.180	0.067	-0.157	-0.084
X3.12	0.340	0.336	0.790	0.130	0.107	0.032	-0.130	-0.006
X3.13	0.232	0.262	0.708	0.144	0.099	-0.012	-0.167	-0.088
X3.14	0.411	0.380	0.765	0.219	0.150	0.017	-0.149	-0.055
X3.15	0.388	0.428	0.780	0.281	0.208	0.046	-0.097	-0.072
Y1.1	0.175	0.196	0.096	0.732	0.143	0.037	-0.093	-0.009
Y1.2	0.334	0.320	0.272	0.896	0.241	-0.042	-0.153	-0.052
Y1.3	0.210	0.366	0.266	0.771	0.240	-0.056	-0.097	-0.029
Y1.4	0.346	0.421	0.300	0.898	0.210	0.043	-0.062	-0.035
Y1.5	0.471	0.434	0.363	0.899	0.275	0.038	-0.135	-0.078
Y2.1	0.152	0.352	0.260	0.180	0.891	-0.185	-0.155	-0.019
Y2.2	0.265	0.358	0.255	0.263	0.944	-0.210	-0.187	-0.013
Y2.3	0.305	0.366	0.331	0.289	0.924	-0.151	-0.206	-0.033
Y2.4	0.135	0.289	0.184	0.229	0.878	-0.221	-0.086	-0.014
Y2. x X1.	-0.174	-0.019	-0.136	-0.129	-0.178	0.500	1.000	0.607
Y2. x X2.	-0.019	-0.145	-0.008	0.006	-0.209	1.000	0.500	0.598
Y2. x X3.	-0.132	-0.007	-0.083	-0.054	-0.022	0.598	0.607	1.000

4.1.5. Structural model testing results

The structural model was analyzed to assess prediction strength and relationship significance between variables. Evaluation was conducted through several main indicators, namely R-square, f-square, Variance Inflation Factor (VIF), Standardized Root Mean Square Residual (SRMR), and Bayesian Information Criterion (BIC). The complete R-square test results are reflected in Table 5: R-square, which shows the contribution of exogenous variables and moderation interaction to the variation in MSME performance.

Table 5: R-Square Values

	R-square	R-square adjusted
Y1. MSME Performance	0.264	0.216

Based on testing results, the R-square value for MSME Performance is 0.264 with an R-square adjusted value of 0.216. This means approximately 26.4% of MSME Performance variation stems from exogenous variables (tax incentives, green product innovation, digital technology) and moderating interactions with government policy. This value is categorized as moderate in organizational behavior research, so there are still other factors outside the model that also affect MSME Performance. [30].

Table 6: F-Square Values

	f-square
X1. Tax Incentives for MSMEs → Y1. MSME Performance	0.025
X2. Green Product Innovation → Y1. MSME Performance	0.077
X3. Digital Technology → Y1. MSME Performance	0.002
Y2. Government Policy → Y1. MSME Performance	0.013
Y2. Government Policy × X1. Tax Incentives for MSMEs → Y1. MSME Performance	0.011
Y2. Government Policy × X2. Green Product Innovation → Y1. MSME Performance	0.021
Y2. Government Policy × X3. Digital Technology → Y1. MSME Performance	0.002

The f-square values for each predictor variable are displayed in full in Table 6: f-square, f-square test results show the relative contribution of each predictor variable to MSME Performance. The f-square value for Green Product Innovation is 0.077, which is in the medium effect category. Meanwhile, Tax Incentives (0.025), Government Policy (0.013), and moderation interactions between Government Policy with Tax Incentives (0.011), with Green Product Innovation (0.021), and with Digital Technology (0.002) are all in the small effect category. The Digital Technology variable (0.002) shows a very low contribution. Overall, these findings confirm that Green Product Innovation provides the most dominant effect on improving MSME Performance compared to other variables.

Table 7: VIF Values

	VIF
X1. Tax Incentives for MSMEs → Y1. MSME Performance	1.526
X2. Green Product Innovation → Y1. MSME Performance	1.663
X3. Digital Technology → Y1. MSME Performance	1.513
Y2. Government Policy → Y1. MSME Performance	1.282
Y2. Government Policy × X1. Tax Incentives for MSMEs → Y1. MSME Performance	1.771
Y2. Government Policy × X2. Green Product Innovation → Y1. MSME Performance	1.864
Y2. Government Policy × X3. Digital Technology → Y1. MSME Performance	2.067

The Variance Inflation Factor (VIF) values for all predictor variables are displayed in full in Table 7: VIF, which shows the level of multicollinearity between variables in the model. Variance Inflation Factor (VIF) testing results show that all predictor variables have values below the threshold of 5. VIF values range from 1.282 to 2.067, meaning that no evidence of multicollinearity was detected between variables within the model. Thus, each exogenous variable and moderation interaction can be declared to stand independently and does not experience excessive information overlap. This condition strengthens the validity of the structural model used in the research.

Table 8: Model Fit Values

Fit summary	Saturated model	Estimated model
SRMR	0.095	0.095
d_ULS	8.893	8.873
d_G	4.915	4.919
Chi-square	2339.792	2337.200
NFI	0.542	0.543

The complete model fit test results, including SRMR, d_ULS, d_G, Chi-square, and NFI values, are displayed in Table 8: Model Fit, which shows the suitability of the research model with the data. Model fit testing results show that SRMR values in both saturated and estimated models are 0.095. Although slightly higher than the ideal threshold of 0.08, this value is still acceptable in exploratory research. The d_ULS values (8.893 vs 8.873) and d_G (4.915 vs 4.919) are relatively consistent between saturated and estimated models, indicating model stability. Meanwhile, Chi-square results of 2,339.792 for the saturated model and 2,337.200 for the estimated model describe the level of model fit to the data. Normed Fit Index (NFI) values of 0.542–0.543 are moderate, thus showing that the research model is an adequate fit while presenting opportunities for further refinement. Ultimately, these model fit test results provide support that the structural model is suitable for further analysis.

4.1.6. Hypothesis testing results

The hypothesis testing results, including path coefficient, T-statistic, and p-value for each relationship, are displayed in full in Table 9: Hypothesis Testing Results.

Table 9: Hypothesis Testing Results

Hypothesis	Path	Path Coefficient	T-statistic	p-value	Conclusion
H1: Effect of X1 on Y1	X1 → Y1	0.168	1.488	0.137	Rejected
H2: Effect of X2 on Y1	X2 → Y1	0.307	2.737	0.006	Accepted
H3: Effect of X3 on Y1	X3 → Y1	0.051	0.431	0.666	Rejected
H4a: Moderation of Y2 on X1 → Y1	Y2 × X1 → Y1	-0.09	0.552	0.581	Rejected
H4b: Moderation of Y2 on X2 → Y1	Y2 × X2 → Y1	0.127	1.034	0.301	Rejected
H4c: Moderation of Y2 on X3 → Y1	Y2 × X3 → Y1	-0.037	0.251	0.802	Rejected

Hypothesis testing results based on path coefficient, T-statistic, and p-value values show that not all hypotheses can be accepted. For H1, the Tax Incentives variable (X1) has a positive effect on MSME Performance (Y1) with a path coefficient of 0.168, but this effect is uninfluential ($p = 0.137 > 0.05$), thus the hypothesis is rejected. Next, H2 proves that Green Product Innovation (X2) has a positive and significant influence on MSME Performance, with a path coefficient of 0.307, T-statistic 2.737, and $p = 0.006 < 0.05$. Thus, hypothesis H2 is accepted.

For H3, the Digital Technology variable (X3) has a positive but non-influential effect on MSME Performance (coefficient 0.051; $p = 0.666 > 0.05$), thus the hypothesis is rejected. In moderation testing (H4a, H4b, and H4c), results show that Government Policy (Y2) is unable to moderate the link between Tax Incentives, Green Product Innovation, and Digital Technology on MSME Performance. This is shown by p-values on all three moderation paths that are all greater than 0.05, thus all three moderation hypotheses are rejected.

Overall, these findings confirm that only Green Product Innovation (X2) is proven to have a significant effect in improving MSME Performance, while Tax Incentives, Digital Technology, and the moderating role of Government Policy were not found to be statistically significant predictors in the model.

4.2. Discussion

4.2.1. Effect of tax incentives on MSME performance

Tax incentives appear to provide positive direction toward MSME performance improvement, but the emerging effect is not strong enough to cause meaningful change. This shows that fiscal policy alone cannot be the main support, as many business actors still face limitations in understanding and accessing these facilities. Low tax literacy often becomes a barrier, so the existence of incentives is not fully translated into practical advantages for small businesses. [32]. Additionally, administrative and bureaucratic complexity factors also potentially weaken policy effectiveness, as shown in the context of small businesses in Nigeria facing similar constraints. [33]. Pursuant to the Minister of Finance Regulation No. 57/2024, digital taxation initiatives are expected to increase voluntary compliance of MSMEs, providing new opportunities for tax incentives to be translated into more tangible performance improvements. Nevertheless, the success of this policy still depends on the internal capacity of business actors to understand and access fiscal facilities, as well as adequate administrative readiness and digital systems. Some MSMEs still face difficulties in operating digital tax platforms, so the potential effect of incentives has not been fully achieved.

This condition indicates that tax incentives will only provide real impact if accompanied by other support, such as intensive assistance and innovation encouragement, which can strengthen MSME capacity in utilizing these policies optimally. This situation can be understood because not all small business actors have the same ability to utilize available fiscal facilities. Limited tax literacy, complex administrative procedures, and limited access to information make tax incentives difficult to directly translate into performance improvement. Similar conditions are reflected in findings by Hosono et al. [34] Showing that tax incentives, on average, do not provide a meaningful impact on SME investment in Japan, although companies that actually utilize them can increase productivity. Picas et al. [35] Confirms that some forms of incentives, particularly those related to innovation, have not been able to produce significant effects on MSME performance sustainability. This shows that fiscal policy effectiveness greatly depends on business actors' readiness and capacity to access and utilize the provided facilities.

4.2.2. Effect of green product innovation on MSME performance

Green product innovation is proven to provide positive and significant effects on MSME performance. Implementation of environmentally friendly product innovation enables business actors to increase competitiveness while responding to market demands, increasingly aware of sustainability issues. Such innovation is not only oriented toward consumer satisfaction but also contributes to resource use efficiency, waste reduction, and creation of new added value that can expand market reach. This aligns with the view that a green innovation strategy is instrumental in strengthening competitiveness through product quality improvement, market differentiation, and a positive image in consumers' eyes. [35].

Additionally, green innovation adoption directly impacts MSME capability in responding to environmental regulations and global market pressure. Hosono et al. [34] highlight that innovation practices based on resource efficiency and sustainability help small companies increase productivity and long-term growth. Thus, green innovation can be viewed as a fundamental strategy that not only supports MSME economic growth but also ensures long-term business sustainability through a combination of efficiency, reputation, and adaptation to market demands.

4.2.3. Effect of digital technology on MSME performance

The evidence also shows that digital technology provides positive but not significant effects on MSME performance. This condition indicates that although digitalization has begun to be adopted, its utilization is still limited to basic functions such as promotion and simple administration, so its impact on performance improvement is not yet optimal. Internal barriers in the form of digital literacy limitations, low human resource competency, capital constraints, and resistance to organizational change are the main factors that reduce technology adoption effectiveness. These findings align with Kahveci. [36] Who confirms that digital adoption by MSMEs is often constrained by resource constraints and skill gaps, so its utilization does not provide significant results without adequate internal capacity support.

Besides internal factors, external barriers such as uneven digital infrastructure, technology implementation costs, and limited institutional support also limit the digitalization impact on MSME performance. Recent studies mention that infrastructure weaknesses and institutional voids become the main obstacles for MSMEs in developing countries to strategically optimize digital technology [37]. In the COVID-19 pandemic context, digital adoption even tends to be reactive and short-term, more oriented toward business continuity rather than sustainable transformation. Papadopoulos [38] Highlights that digital technology use by MSMEs during crises has not been strong enough to provide a significant impact on long-term performance. Thus, these research results strengthen the understanding that digitalization adoption needs to be supported by digital literacy improvement, infrastructure support, and consistent transformation strategies to be able to provide significant contributions to MSME competitiveness and sustainability.

4.2.4. Moderation of government policy on the relationship between tax incentives, green product innovation, digital technology, and MSME performance

In line with recent developments, the Indonesian government, through the 2025 State Budget (APBN), has established the theme “Acceleration of Inclusive and Sustainable Economic Growth”, with budget allocation to support MSME digitalization, human resource development, infrastructure, and green industry (Ministry of Finance of the Republic of Indonesia, 2025). In addition, the Indonesia Digital Transformation Roadmap 2025–2045 emphasizes the expansion of quality digital access, improvement of digital literacy, development of digital talent, as well as promoting digitalization of productive sectors and the green economy (Ministry of Communication and Informatics of the Republic of Indonesia, 2024). This policy serves as an important foundation for research that assesses the extent to which government support can strengthen the role of tax incentives, green innovation, and digital technology on MSME performance.

This research finds that government policy does not play a role as a moderator in the relationship between tax incentives, green innovation, and digital technology with MSME performance. These findings align with international studies showing that policy effectiveness is often limited to the conceptual level but does not always have real implications in the field. Hosono et al. [34] Found that tax incentives do not automatically increase capital investment in all MSMEs, but only impact companies that actually utilize them, so policy effects tend to be selective and not comprehensive. This explains why in this research context, tax incentive policy has not been able to strengthen MSME performance significantly, especially due to limited tax literacy and bureaucratic complexity.

Similar conditions also exist in the correlation between green innovation and digital technology with MSME performance. R. Ullah et al. [39] Found that government incentives do reinforce the relation between green innovation and environmental practices, but do not moderate the relationship between green innovation and community development, so the main contribution still comes from internal factors such as creativity and business actors’ innovation capacity. Similarly, F. Ullah et al. [40] Confirms that government support only plays a partial role, while internal factors in the form of financing access and innovation capability have a more dominant influence on MSME sustainable performance. Thus, these research findings strengthen the understanding that government policy intervention, although important, is not sufficient to moderate effectively without MSME internal readiness and concrete implementation support in the field.

5. Conclusion

Hypothesis testing results show that of six proposed hypotheses, only one is proven significant, namely the effect of green product innovation on MSME performance. These findings confirm that environmentally friendly product innovation is essential in increasing MSME competitiveness and performance, both financially and non-financially. Meanwhile, tax incentives and digital technology, although having positive effects, do not show significance on MSME performance. This indicates that both factors have not been optimized by MSME actors. Tax incentives are often not yet utilized due to limited tax literacy and bureaucracy, while digital technology still faces barriers in the form of HR limitations, implementation costs, and resistance to change. Additionally, testing results also show that government policy does not play a role as a moderating variable in the association of tax incentives, green product innovation, and digital technology on MSME performance. This condition shows a gap between government-formulated policies and field implementation. In other words, MSME success is more determined by company internal factors, particularly creativity, innovation, and adaptation capability, compared to existing policy support. Overall, this research emphasizes that green innovation strategy is a key factor in improving MSME performance, while tax incentives, digitalization, and government policy still require strengthening to be able to provide more tangible impact.

References

[1] Vial G. Understanding digital transformation: A review and a research agenda. *J Strateg Inf Syst*. 2019;28(2):118–144. https://doi.org/10.1016/j.jsis.2019.01.003.

[2] Sebastian IM, Ross JW, Beath C, Mocker M, Moloney KG, Fonstad NO. How Big Old Companies Navigate Digital Transformation. In: *Strategic Information Management*. Routledge; 2020:133-150. https://doi.org/10.4324/9780429286797-6.

[3] Henriette E, Feki M, Boughzala I. The Shape of Digital Transformation: A Systematic Literature Review. In: *9th Mediterranean Conference on Information Systems*. 2015.

[4] Ross JW, Beath CM, Sebastian IM. Digitized ≠ Digital. *MIT Cent Inf Syst Res*. Published online 2017.

[5] Gurbaxani V, Dunkle D. Gearing Up For Successful Digital Transformation. *MIS Q Exec*. 2019;18(3):209-220. https://doi.org/10.17705/2msqe.00017.

[6] Westerman G, Bonnet D, McAfee A. *Leading Digital: Turning Technology into Business Transformation*. Harvard Business Press; 2014.

[7] Chen YS. The Driver of Green Innovation and Green Image – Green Core Competence. *J Bus Ethics*. 2008;81(3):531-543. https://doi.org/10.1007/s10551-007-9522-1.
[8] Porter ME, Van der Linde C. Toward a new conception of the environment-competitiveness relationship. *J Econ Perspect*. 1995;9(4):97-118. https://pubs.aeaweb.org/doi/pdf/10.1257/jep.9.4.97.
[9] Kemp R, Arundel A, Smith K. *Survey Indicators for Environmental Innovation*. IDEA paper series; 1998.
[10] Chiou TY, Chan HK, Lettice F, Chung SH. The influence of greening the suppliers and green innovation on environmental performance and competitive advantage in Taiwan. *Transp Res Part E Logist Transp Rev*. 2011;47(6):822-836. https://doi.org/10.1016/j.tre.2011.05.016.
[11] Lin J, Chang HJ. Should Industrial Policy in Developing Countries Conform to Comparative Advantage or Defy it ? A Debate Between Justin Lin and Ha-Joon Chang. *Dev Policy Rev*. 2009;27:483-502. https://doi.org/10.1111/j.1467-7679.2009.00456.x.
[12] Mentari M, Indriani E, Astuti W. Analisis Faktor-Faktor Yang Memengaruhi Pengungkapan Corporate Social Responsibility (CSR) Pada Perusahaan PertambanganYang Terdaftar Di BEI Pasca Pandemi Covid-19. *J Ris Mhs Akunt*. 2024;4(3):426-441. https://doi.org/10.29303/risma.v4i3.1232.
[13] Mahirun M. Keberlanjutan Dan Nilai Perusahaan: Analisis Praktik Green Innovation Pada Perusahaan. *Transekonomika Akuntansi, Bisnis Dan Keuang*. 2024;4(5):740-755. https://doi.org/10.55047/transekonomika.v4i5.716.
[14] Hidayah N, Avisca G. Pelatihan Kompetensi Kewirausahaan Pada UKM. *J Sustain Community Serv*. 2021;1(3):96-106. https://doi.org/10.55047/jscs.v1i3.408.
[15] Djakasaputra A, Christinio E, Jayanti YA. Motivational Training To Enhance Entrepreneurial Success. *J Sustain Community Serv*. 2024;4(3):201-210. https://doi.org/10.55047/jscs.v4i3.751.
[16] Brennen JS, Kreiss D. Digitalization. In: *The International Encyclopedia of Communication Theory and Philosophy*. Wiley; 2016:1-11. https://doi.org/10.1002/9781118766804.wbiect111.
[17] Parida V, Sjödin D, Reim W. Reviewing Literature on Digitalization, Business Model Innovation, and Sustainable Industry: Past Achievements and Future Promises. *Sustainability*. 2019;11(2):391. https://doi.org/10.3390/su11020391.
[18] Mostaghel R, Oghazi P, Parida V, Sohrabpour V. Digitalization driven retail business model innovation: Evaluation of past and avenues for future research trends. *J Bus Res*. 2022;146:134-145. https://doi.org/10.1016/j.jbusres.2022.03.072.
[19] Susilowati A, Mappanyukki R. The Impact of Digital Taxation Implementation and Taxpayer Knowledge on Tax Revenue Obstacles, Moderated by Incentive Policy. *The Winners*. 2024;24(2):147-157. https://doi.org/10.21512/tw.v24i2.10958.
[20] Tambunan MRUD. Adopting BEPS Inclusive Framework in Indonesia:Taxation Issues and Challenges in a Digital Era. *BISNIS BIROKRASI J Ilmu Adm dan Organ*. 2021;27(3). https://doi.org/10.20476/jbb.v27i3.11829.
[21] Ginting HB, Rijal S. Assessing The Role Of Environmental Innovation, Credit Access, And Governance In Shaping The Financial Sustainability Of Indonesian MSMEs. *COSTING J Econ Bus Account*. 2024;7(4):10834-10852. https://doi.org/10.31539/costing.v7i4.9655.
[22] Anatan L, Nur. Micro, small, and medium enterprises' readiness for digital transformation in Indonesia. *Economies*. 2023;11(6):156. https://doi.org/10.3390/economies11060156.
[23] Mentari S, Sudarmiatin S, Rahayu WP. Exploring The Synergy of Green Innovation and Digital Transformation for Enhancing SME Performance: A Systematic Literature Review. *J Ekon Kreat dan Manaj Bisnis Digit*. 2024;3(2):117-136. https://doi.org/10.55047/jekombital.v3i2.809.
[24] Panuju AYT, Bakri S. Green Innovation for SMEs in Indonesia–A Literature Analysis. *J Eng Sci Res*. 2024;6(1):16-22. https://doi.org/10.23960/jesr.v6i1.157.
[25] Sisca S, Wijaya A. The role of green innovation to achieve sustainable business performance of MSMEs in the covid-19 pandemic. *Int J Sci Technol Manag*. 2023;4(1):228-232. https://doi.org/10.46729/ijstm.v4i1.750.
[26] Kaplan RS, Norton DP. *The Balanced Scorecard: Translating Strategy Into Action*. Harvard Business School Press; 1996.
[27] Horbach J, Rammer C, Rennings K. Determinants of eco-innovations by type of environmental impact — The role of regulatory push/pull, technology push and market pull. *Ecol Econ*. 2012;78:112-122. https://doi.org/10.1016/j.ecolecon.2012.04.005.
[28] Kusumastuti A, Khoiron AM, Achmad TA. *Metode Penelitian Kuantitatif*. Deepublish; 2021.
[29] Hair J, Alamer A. Partial Least Squares Structural Equation Modeling (PLS-SEM) in second language and education research: Guidelines using an applied example. *Res Methods Appl Linguist*. 2022;1(3):100027. https://doi.org/10.1016/j.rmal.2022.100027.
[30] Hair Jr JF, Hult GTM, Ringle CM, Sarstedt M, Danks NP, Ray S. *Partial Least Squares Structural Equation Modeling (PLS-SEM) Using R: A Workbook*. Springer Nature; 2021. https://doi.org/10.1007/978-3-030-80519-7.
[31] Fornell C, Larcker DF. Evaluating structural equation models with unobservable variables and measurement error. *J Mark Res*. 1981;18(1):39-50. https://doi.org/10.1177/002224378101800104
[32] Budiman NA, Nurkamid M, Sriyana J, Akhsyim A. Can Tax Incentives Affect MSME Tax Compliance? *Int J Multidiscip Appl Bus Educ Res*. 2022;3(11):2198-2205. https://doi.org/10.11594/ijmaber.03.11.06.
[33] Ellawule A, Bashir YM, Dalhat BS, Suleiman N. Effect of tax incentives on MSMEs' tax compliance in Nigeria. *J Bus Manag Account*. 2024;14(2):339-365. https://doi.org/10.32890/jbma2024.14.2.6.
[34] Hosono K, Hotei M, Miyakawa D. Causal effects of a tax incentive on SME capital investment. *Small Bus Econ*. 2023;61:539–557. https://doi.org/10.1007/s11187-022-00709-3.
[35] Picas S, Reis P, Pinto A, Abrantes JL. Does tax, financial, and government incentives impact long-term portuguese smes' sustainable company performance? *Sustainability*. 2021;13(21):11866. https://doi.org/10.3390/su132111866.
[36] Kahveci E. Digital transformation in SMEs: enablers, interconnections, and a framework for sustainable competitive advantage. *Adm Sci*. 2025;15(3):107. https://doi.org/10.3390/admsci15030107.
[37] Faiz F, Le V, Masli EK. Determinants of digital technology adoption in innovative SMEs. *J Innov Knowl*. 2024;9(4):100610. https://doi.org/10.1016/j.jik.2024.100610.
[38] Papadopoulos T. The use of digital technologies by small and medium enterprises during COVID-19: Implications for theory and practice. *Int J Inf Manage*. 2020;55:102192. https://doi.org/10.1016/j.ijinfomgt.2020.102192.
[39] Ullah R, Ahmad H, Rehman FU, Fawad A. Green innovation and Sustainable Development Goals in SMEs: The moderating role of government incentives. *J Econ Adm Sci*. 2023;39(4):830-846. https://doi.org/10.1108/JEAS-07-2021-0122.
[40] Ullah F, Degong M, Anwar M, Hussain S, Ullah R. Supportive tactics for innovative and sustainability performance in emerging SMEs. *Financ Innov*. 2021;7(1):80. https://doi.org/10.1186/s40854-021-00284-8.