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Integration of Green Accounting and Green Intellectual Capital as a Sustainability Strategy for MSMEs in Medan City

Irna Triannur Lubis[1*], Idhar Yahya[2], Robert Sibarani[3], Mangasi Sinurat[4]

[1,2,3]*Fakultas Ekonomi dan Bisnis, Universitas Sumatera Utara*
[4]*Fakultas Ekonomi dan Bisnis, Sekolah Tinggi Ilmu Ekonomi Bina Karya Tebing Tinggi*

* *irnatriannurlubis@gmail.com*

Abstract

This study aims to analyze the influence of green accounting and green intellectual capital on the sustainability of micro, small, and medium enterprises (MSMEs) in Medan City. The quantitative approach was used with the survey method against 120 MSME actors operating in the trade, services, and manufacturing sectors. Data collected through a structured questionnaire were analyzed using multiple linear regression for hypothesis testing research. Research results show that green accounting has a significant positive effect on the sustainability of MSMEs, which indicates that recording and reporting finance-based environments push efficiency, source power, and compliance regulations. Meanwhile, that is, green intellectual capital, which includes knowledge, innovation, and competence, and the environment also has a positive significant influence, indicating the strategic role of the source of human and intellectual power in integrating practical friendly environments. Findings This data confirms that the combination of the application of green accounting and the optimization of green intellectual capital is able to increase power competition at a time of sustainability for MSME businesses. Implications study This encourages MSME actors, policymakers, and institutions to develop training programs and incentives that integrate accounting with green and intellectual capital management in their environments.

Keywords: Green Accounting, Green Intellectual Capital, Sustainability, MSMEs, Medan.

Introduction

Issue sustainability is increasing come to the fore in the modern business world along with increasing awareness will impact negative activity economy to environment. Not only company Large, Micro, Small and Medium Enterprises (MSMEs) are also required for integrate principal sustainability in operational they. MSMEs have role strategic in Indonesian economy with contribution by 60.5% of Product Gross Domestic Product (GDP) and absorption power Work more of 97% (BPS, 2024). However, behind contribution said, many MSMEs still face challenge Serious related management impact environment, starting from waste production, consumption wasteful energy, so that low awareness perpetrator business to importance business friendly environment.

One of relevant approach for overcome problem the is green accounting, namely the process of identification, measurement and reporting cost as well as benefit environment in report finance (Putri & Rahman, 2023). Concept This Not only help company comply regulation, but also encourage efficiency use source power, reduce cost operational, and improve image effort in the eye's consumers.

In addition, success implementation principal sustainability is also influenced by green intellectual capital which includes knowledge, skills, and innovation based the environment owned company (Chen, 2011). With

intellectual capital strong green, MSMEs can develop product friendly environment, improve efficiency of the production process, and building a marketing strategy that supports sustainability.

Medan City, as center economy the largest in North Sumatra, has more of the 170 thousand MSMEs spread across various sectors, including trade, culinary, manufacturing, and services (Medan City Cooperatives and SMEs Service, 2024). However, some large MSMEs in the city This Still face constraint in implementation practice friendly environment. For example, some industry House stairs in Medan reported throw away waste cooking oil and plastic direct to water channels, causing pollution and complaints society. The low adoption of green accounting and it lack ability in managing green intellectual capital to become inhibiting factors achievement sustainability the.

Several studies previously has study connection between green accounting, green intellectual capital, and sustainability business. For example, research Yadiati and Mubarok (2017) found that the implementation of green accounting contributes significant to improvement performance environment and economy company. Meanwhile that, Chen (2011) proved that green intellectual capital plays a role important in create superiority competitive based sustainability. A study by Alhaddi (2015) also shows that integration aspect environment in business strategy can increase performance term long. However, some big study This company focused big or industry certain, so that study specifically for MSMEs in the context urban like Medan still limited.

Based on findings study previously, it was seen that study about the relationship between green accounting and green intellectual capital with sustainability of MSMEs is still seldom carried out, especially in the area with characteristics economic and social such as Medan. In addition, there is still minimal research that tests second variables the in a way simultaneous to sustainability of MSMEs in urban areas of Indonesia.

Study This aim for test in a way empirical the influence of green accounting and green intellectual capital on sustainability of MSMEs in Medan City. The results expected can enrich literature about accountancy environment and intellectual capital green, at the same time give recommendation strategic for MSME actors, government area, and maker policy.

Literature Review

MSMEs, especially in cities like Medan, often hampered by limited capital, knowledge and access technology. However, literature national recorded effectiveness simple green accounting training and increasing green human capital in push innovation products and loyalty customer.

Green Accounting is an approach that integrates environmental factors such as waste management costs, pollution, and conservation into an organization's financial statements. This helps improve transparency, operational efficiency, and supports environmentally oriented decision making (Etty, 2024).

Several studies from international journals (Journal of Cleaner Production, Ecological Economics) shows that organizations that implement green Accounting tends to report reduced energy consumption and waste, and gains market recognition from environmentally conscious consumers .

Green intellectual capital (GIC) which includes green human capital (knowledge and skills) environment), green structural capital (systems and culture) supporters' innovation green), and green relational capital (stakeholder relationships for objective environment) has proven play role important in development innovation green and performance environment.

High GIC rate show capability innovation more green superior, including combination exploration and exploitation (ambidextrous innovation), which has an impact directly on the increase performance environment. Other research in the journal *Sustainability* highlighting GIC as source Power does not form that allows company developing environmental strategies more adaptive and responsive to pressure external, such as demands customers and regulations environment.

Methods

Study This use approach quantitative with explanatory research method, which aims for test connection causal between Green Accounting (GA), Green Intellectual Capital (GIC), and MSME Sustainability variables. This design chosen Because study focus on testing hypothesis based on theory and research previously, with analysis statistics as tool testing .

The population in this study was all Micro, Small, and Medium Enterprises (MSMEs) operating in Medan City and with at least three years of business experience. The sampling technique used was purposive sampling with the following criteria:

1. MSMEs that have implemented accounting practices at least in accordance with basic standards.
2. MSMEs that have activities or policies related to environmental sustainability.
3. Owners/managers were willing to complete the research questionnaire.

The number of samples was determined using the Slovin formula with an error rate of 5%, resulting in 150 respondents.

Variables Independent Green Accounting is measured with indicator reporting cost environment , investment friendly environment , and disclosure information environment (Burritt & Schaltegger, 2010).

Variables Independent Green Intellectual Capital is measured based on dimensions of Human Capital, Structural Capital, and Relational Capital that are oriented towards the environment (Chen, 2008).

Variables Dependent The sustainability of MSMEs is measured with indicator sustainability economic , social, and environmental (Triple Bottom Line, Elkington, 1998).

Data Collection Techniques were collected through :

1. Questionnaire closed with Likert scale 1–5.
2. Interview short For clarification answer respondents .
3. Related documentation report finance and activities MSME environment .

Data analyzed using Partial Least Square Structural Equation Modeling (PLS-SEM) with SmartPLS software, through stages :

1. Outer Model Test: validity convergent , validity discriminant , and reliability composite .
2. Inner Model Test: coefficients determination (R^2), significance test path coefficient, and predictive relevance (Q^2).
3. Hypothesis Testing : through bootstrapping with level significance 5%.

Results and Discussion

Results

Outer Model Test

Convergent Validity

Predictor or the item is declared valid if loading factor value > 0.7. From the results analysis with running calculate PLS algorithm is obtained results a number of indicator own loading factor value < 0.7 so that done elimination (see Figure 2). Have Outer Loadings value < 0.7 means Not yet fulfil convergent validity conditions so must done cleaning with method delete indicator said . After done deletion to indicators that have a loading factor < 0.7, then done testing back . After done testing until all Outer Loadings indicator value > 0.7 according to standardization SmartPLS 4.0, results testing can seen in Figure 2.

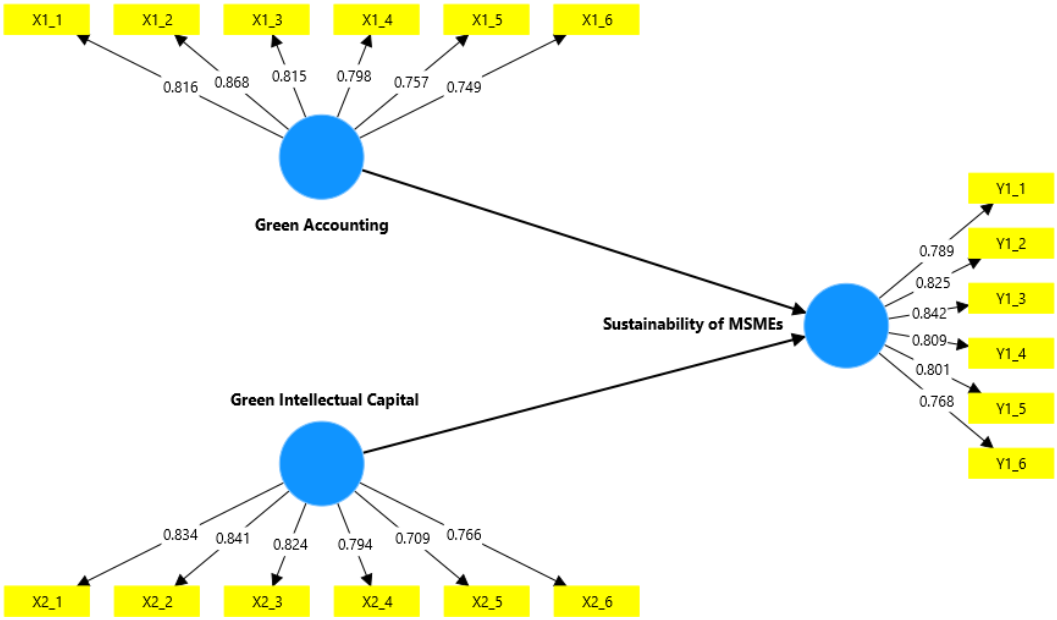

Figure 2. Factor Loading Test

Average Variance Extracted (AVE)

Construct can is said to be valid if own AVE value > 0.5.

Table 1. Composite Reliability

	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted (AVE)
Green Accounting	**0.889**	**0.897**	**0.915**	**0.643**
Green Intellectual Capital	**0.885**	**0.896**	**0.912**	**0.634**
Sustainability of MSMEs	**0.892**	**0.893**	**0.918**	**0.650**

Cronbach Alpha, Average Variance Extracted (AVE) Based on Table 1 above can seen that all construct own AVE value > 0.5 which means every indicator own valid construct .

Discriminant Validity

Discriminant validity is something stages carried out For know whether variables or indicator in research conducted own unique and unique value related with variables or the indicators alone, and No from variable or indicator beyond expectations. A study it is said own validity good discriminant, if cross loading results show that indicator from every construct own mark more tall compared to indicators on the construct other.

Table 2. Calculation of Cross Loadings Values

	Green Accounting	Green Intellectual Capital	Sustainability of MSMEs
X1_1	**0.816**		
X1_2	**0.868**		
X1_3	**0.815**		
X1_4	**0.798**		
X1_5	**0.757**		
X1_6	**0.749**		
X2_1		**0.834**	
X2_2		**0.841**	
X2_3		**0.824**	
X2_4		**0.794**	
X2_5		**0.709**	
X2_6		**0.766**	
Y1_1			**0.789**
Y1_2			**0.825**
Y1_3			**0.842**
Y1_4			**0.809**
Y1_5			**0.801**
Y1_6			**0.768**

From Table 2 above can seen that cross loading value of each item against the construction more big than loading value with construct others. In addition to the cross loading value, a study it is said has good discriminant validity, if mark Fornell Larcker criterion, namely root from AVE on the construct more tall compared to correlation construction with other latent variables.

Table 3. Fornell-Larcker Criterion Values

	Green Accounting	Green Intellectual Capital	Sustainability of MSMEs
Green Accounting	0.802		
Green Intellectual Capital	0.562	0.796	
Sustainability of MSMEs	0.574	0.617	0.806

From Table 3 we can seen that AVE root for all variables more big from the correlation with other variables. The AVE root of Each variable is : Financial Literacy at 0.795. Financial Sustainability at 0.885. Gender Innovation at 0.865. Green Intellectual Capital at 0.852. So can concluded that study This own validity good discriminant.

1. Composite Reliability

Composite Reliability is used For test the reliability of each indicator in the study . A variables can it is said reliability if own composite reliability value > 0.7. From table 3 it can be seen seen that all indicators in research This has own good reliability Because Composite Reliability value > 0.7.

2. Cronbach Alpha
   Besides Composite Reliability, another way to determine reliability of research indicators is with see value on Cronbach Alpha. Instrument or questionnaire it is said reliable If Cronbach's Alpha value > 0.6. From table 3 it can be seen seen that every construct has own good reliability Because Cronbach's Alpha value > 0.6.

Inner Model Test

R- Square

The R-Square value is used For see how much big variables free can explain variables bound. Based on Table 4 it can be seen that R-Square value of Financial Sustainability is 0.660 or 66%. This is show that 66% of the Financial Sustainability variable is influenced by Green Intellectual Capital, Financial Literacy, and Gender Innovation. Meanwhile, 34% is influenced by variables other than those studied. From the figures said, can categorized that variables dependent can explained by variables independent with scale moderate.

Table 4. R-Square

	R- square	Adjusted R- square
Sustainability of MSMEs	**0.457**	**0.447**

Testing Hypothesis

Hypothesis testing done with see results coefficient path (Path Coefficient) and p- value obtained through the bootstrapping process with the alpha used of 0.05 (see Table 5).

Table 5. Path Coefficient

	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P values
Green Accounting -> Sustainability of MSMEs	0.332	0.335	0.074	4,478	0.000
Green Intellectual Capital -> Sustainability of MSMEs	0.430	0.431	0.067	6,413	0.000

From Table 5 it can be seen that seen that :

Green Accounting for Sustainability of MSMEs

1) Path Coefficient (O) = 0.332. This means that every 1 unit increase in *Green Accounting implementation* will increase MSME sustainability by 0.332 points (positive relationship).
2) T-Statistic = 4.478 > 1.96 and P- Value = 0.000 < 0.05. Showing that this effect is statistically significant.
3) Academic Interpretation: These results are in line with the literature (Al- Homaidi et al. , 2022) which states that the implementation of environmentally friendly accounting helps MSMEs manage resources more efficiently, comply with environmental regulations, and improve business image, thereby strengthening long-term sustainability.

Green Intellectual Capital towards Sustainability of MSMEs

1) Path Coefficient (O) = 0.430. Shows a stronger positive influence than *Green Accounting* ; a 1 unit increase in *Green Intellectual Capital* increases MSME sustainability by 0.430 points.
2) T-Statistic = 6.413 > 1.96 and P- Value = 0.000 < 0.05. The relationship is statistically significant.
3) Academic Interpretation: These findings support the *resource-based view theory* (Barney , 1991) that knowledge, skills, and environmental-based innovation from human resources are strategic assets that drive the competitiveness and sustainability of MSMEs (Kumar & Rahman, 2019).

Discussion

Research result find that Green Accounting has influence positive significant to the sustainability of MSMEs in Medan City. This in line with studies Nwokah & Hamza (2022) shows that green accounting practices improve the ability of MSMEs in manage source power and strengthen performance environment, especially when combined with orientation strong environment.

Green Intellectual Capital (GIC) also provides contribution positive to sustainability of MSMEs. A recent study by Wang, Zhang & Liu (2021) confirms that increasing intellectual capital including knowledge and systems based environment support repair achievements ecological in scale business small and medium

These findings reinforce the evidence that Green Innovation is a key mediator between GIC and sustainability. Ahmed, Wang & Mubin (2023) reported that GIC encourages green innovation in MSMEs, which subsequently significantly improves environmental performance. Singh & Gupta's (2020) study also emphasized that the adoption of environmentally friendly technological innovations is a significant mediator between environmental knowledge and ecological performance in the MSME context.

In addition, Li, Meng & Mulmi (2024) showed that the combination of green Accounting practices with good corporate governance mechanisms strengthen the influence of sustainability on MSMEs. This finding is relevant for MSMEs in Medan, where an inclusive managerial structure can strengthen the effectiveness of green practices. accounting .

From the perspective theory *Natural Resource-Based View (NRBV)*, results This support idea that capability environment good in measurement (green accounting) and intellectual capital (GIC) are asset strategic that can strengthen characteristics superiority competitive based sustainability. A 2024 study by Li et al. presents proof empirical that second aspect That Can each other strengthening, especially in the MSME sector.

For MSMEs, it is important for strengthen application of green accounting, for example with system internal reporting and training management waste. Research Nwokah & Hamza (2022) recommend that MSMEs align practice accountancy green with a holistic environmental strategy for deepen impact positive. In addition, developing GIC through improvement human resource capacity and innovation product will strengthen Power stand business in an increasingly competitive market care about sustainability.

Study This limited to cross-sectional data, so that not enough reflect dynamics change term length. Ahmed et al.'s (2023) study suggests use longitudinal study for track GIC evolution and innovation green in a way

sustainable in MSMEs. In addition, the expansion sample to other areas in Indonesia will increase generalization results.

Conclusion

Study This prove that the implementation of Green Accounting and management of Green Intellectual Capital has an impact significant to Sustainability of MSMEs in Medan City. Findings This show that environmentally oriented accounting No only become instrument reporting finance, but also means strategic for increase efficiency source power, reduce impact negative to environment, as well as strengthen reputation business.

In addition, Green Intellectual Capital, which includes knowledge, skills, and innovation friendly environment from source Power human, proven capable push innovation sustainable as well as increase Power MSME competitiveness. Second integration draft the show synergy that is capable create mark plus economy at a time guard sustainability environment.

In a way practical, results study This recommend that MSME actors in Medan City increase capacity in Implementing Green Accounting and optimally utilizing Green Intellectual Capital. regions and institutions supporters expected can provide training, incentives, and regulations that encourage transformation going to business sustainable.

With Thus, strengthening practice accountancy green and intellectual capital green no only contribute to performance environment and economy, but also ensure sustainability of MSMEs in face increasing market challenges competitive and sustainability oriented.

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