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# The Effect of Environmental Management Accounting and Control System Integration on Sustainability Orientation through Sectoral Green Economy Mediation

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## ABSTRACT

The orientation of sustainability within the scope of the company refers to the company's efforts to create long-term value by taking into account the social, environmental and economic impacts of the company's business activities. To achieve the goals of organizational development, companies must carry out effective environmental management. Company activities that are inseparable from natural resources must pay attention to the condition of the surrounding environment so as not to cause damage to the environment. The purpose of this study is to analyze how far the influence of environmental management accounting (EMA) factors and the integration of control systems on the company's sustainability orientation. Then in this study will also analyze the effect of sectoral green economy (SGE) as a mediating factor. The use of green economy sectoral factors aims to create an economy that also focuses on environmental protection. The research method used is a quantitative research method. The number of samples used in this study were 512 respondents. Respondents who were sampled were managers and employees of state-owned, mining and plantation companies in Indonesia. The sampling technique used was purposive sampling technique. Then the data were analyzed using SmartPLS software. From the results of the research above, it can be concluded that the EMA and control system integration (CSI) variables have a significant effect on SGE and sustainability orientation. Then the SGE is also capable of being a good mediating factor in bridging the influence of EMA and CSI on sustainability orientation.

**Keywords:** Environmental Management Accounting, Control System Integration, Sectoral Green Economy, Sustainability Orientation

**JEL Classifications:** O13, K32, Q01

## 1. INTRODUCTION

The orientation of sustainability within the scope of the company refers to the company's efforts to create long-term value by taking into account the social, environmental and economic impacts of the company's business activities (Baumgartner and Rauter, 2017). This involves identifying risks and opportunities in various aspects of operations, including supply chain, energy, waste and resource use. In implementing a sustainable orientation, companies must adopt a holistic and sustainable approach to the company's business activities. This includes integrating sustainability principles into business strategy, policies and operational practices.

Companies must prioritize transparency and accountability in managing the social and environmental impacts of the company's business (Pop et al., 2011). A sustainability orientation can also help companies manage long-term risks and create long-term value by taking into account social and environmental impacts (Flammer and Bansal, 2017). Companies can also gain additional benefits, such as increasing the company's credibility and reputation, and increasing employee satisfaction and engagement.

To achieve the goal of a sustainability orientation, companies must carry out effective environmental management (Wu, 2017; Scarpellini et al., 2020). This includes measuring, monitoring and

reporting the environmental impact of the company's business activities and developing strategies to reduce these impacts. The environmental management system requires environmental information support as a basis for making decisions related to the environment (Doorasamy and Garbharran, 2015). However, in this case the traditional management accounting system cannot provide the necessary environmental information for environmental decision-making. Functional classification of costs (direct material costs, direct labor costs and overhead costs) causes costs related to the environment to tend to be included and hidden in overhead costs so that managers find it difficult to find and control them (Dascalu et al., 2010; Xiaomei, 2004; Brown et al., 2014).

Therefore, environmental management accounting (EMA) exists to overcome the limitations of traditional management accounting by bringing out environmental aspects in the company's management accounting system. Kumalawati et al. (2023) EMA considers environmental aspects in planning, controlling, measuring performance, and reporting. In performance measurement, EMA can assist management in determining environmental performance indicators, such as energy use, greenhouse gas emissions, waste and measuring company progress in achieving company environmental goals (Latan et al., 2018; Rounaghi, 2019). Meanwhile, in reporting, EMA can assist companies in conveying more detailed information about the environmental impact of the company's business activities to stakeholders such as regulators, customers, investors and the general public (Chen et al., 2020).

Then, implementing the integration of control systems within the company also has a positive effect on achieving the goals of the company's sustainability orientation. Integration of control systems within the company is very important to ensure that the company's business activities run effectively and efficiently. Wijethilake (2017) the company's control system includes processes and procedures designed to ensure that company goals are achieved in a way that meets ethical and legal standards. Integrating environmental control systems into the company's business operations, companies can minimize environmental risks, meet sustainable environmental standards and achieve corporate sustainability orientation goals in ways that meet ethical and legal standards. By paying attention to environmental aspects in company activities and with increasing environmental damage, ecological/environmental aspects are becoming an important concern. Yasa (2010) economic development will develop rapidly by embracing a sectoral green economy (SGE). This SGE is oriented towards the relationship between natural ecosystems and human resources. The SGE does not rely on fossil fuels. The existence of a SGE is useful for minimizing the impact of human economic activities on climate change and global warming (Putthiwanit, 2016). This SGE will affect the company's long-term sustainability and environmental conditions (Goodman and Salleh, 2013).

The purpose of this study is to analyze how far the EMA and control system integration (CSI) factors influence the company's sustainability orientation. Then in this study will also analyze the effect of SGE as a mediating factor that will bridge the influence of independent variables (EMA and CSI) on the dependent

variable (sustainability orientation). The use of green economy sectoral factors aims to create an economy that also focuses on environmental protection (Borel-Saladin and Turok, 2013). Company activities that are inseparable from natural resources must pay attention to the condition of the surrounding environment so as not to cause damage to the environment. In particular, this SGE aims to transform the economic system towards an economy that produces less greenhouse gases while maintaining high economic growth.

## 2. LITERATURE REVIEW AND HYPOTHESIS

### 2.1. EMA

EMA is an accounting system that calculates and manages environmental costs and benefits from a company's business activities (Latan et al., 2018). EMA aims to help companies measure, monitor and manage the environmental impact of the company's business activities effectively. Then, EMA, environmental costs and benefits are calculated as part of the wider business costs and benefits (Rounaghi, 2019). This includes costs and benefits related to natural resource use, pollution, emissions, waste management and environmental conservation efforts. Burritt et al. (2019) by using EMA, companies can identify and reduce unnecessary environmental costs and increase the efficiency of natural resource use. EMA can also help companies to comply with applicable environmental regulatory requirements (Langfield-Smith and Smith, 2003; Mia, 1993).

Agustia et al. (2019) EMA encourages companies to use more environmentally friendly technologies and minimizes the waste they produce. In the context of SGE development, EMA can also help companies identify new sustainable business opportunities and develop environmentally friendly products or services. Therefore, it is hoped that it can increase the competitiveness of companies in facing global competition and expanding a wider market (Sari, 2021). The application of EMA can make a positive contribution to SGE development by increasing the efficiency of resource use (Gunaratne et al., 2021). EMA also helps companies measure the environmental impact of the company's business activities, so that companies can take action to reduce these impacts and increase the efficient use of natural resources. Thus, companies can achieve sustainability goals and maintain a healthy environment for the future. By using EMA, companies can monitor the company's sustainability performance continuously and make sustainability reports transparent to stakeholders (Zsóka and Vajkai, 2018; Latan et al., 2018). EMA plays an important role in helping companies to integrate sustainability into the company's business strategy and increase the company's awareness and responsibility towards the environment and surrounding communities.

H1a: EMA influences SGE.

H1b: EMA influences sustainability orientation.

### 2.2. CSI

CSI refers to the integration of environmental control systems into a company's business operations. In the SGE context, CSI improves environmental performance of companies in certain sectors by

integrating sustainable business practices into business operations (Masuin et al., 2020). Whereas in the context of sustainability orientation, CSI helps companies to integrate sustainability goals into the company's business strategy and ensures that the company's business activities are consistent with sustainability principles. CSI helps companies to measure their sustainability performance and create transparent sustainability reports and helps companies to improve company operational efficiency and reduce the environmental impact of company business activities (Da Silva Fernandes et al., 2023). CSI helps companies to identify sources of emissions and waste that have the potential to damage the environment and take action to reduce these impacts and ensure that the company's business activities comply with environmental regulations related to sustainability. Ikram et al. (2019) CSI has a positive impact on sustainability orientation in companies by helping companies to integrate sustainability goals, improve operational efficiency and reduce the environmental impact of company activities and ensure that the activities carried out by these companies comply with environmental regulations and international standards relating to sustainability.

H2a: CSI affects SGE.

H2b: CSI has an effect on sustainability orientation.

### 2.3. SGE

SGE is a concept that involves sustainable economic development in certain sectors taking into account environmental aspects. The SGE changes the economy, which was originally only about profit and welfare, into a green economy that is more oriented towards environmental sustainability. With a green economy, it is hoped that it can overcome existing environmental problems (Dianjaya and Epira, 2020). Tasri and Karimi (2014) the greater the community's economic activity will cause an increase in environmental problems. In line with the research of Adams et al. (2019), companies that use natural resources as their main capital to get profits, these companies cannot compensate for natural damage caused by their economic activities. Companies that rely mostly on natural resources must pay attention to aspects of environmental protection and preservation so that the activities carried out by companies do not cause damage to the environment. Thus, SGE is deemed appropriate as a supporter of sustainable development (Knight, 2017).

H3: SGE influences sustainability orientation.

Furthermore, to achieve the goal of corporate sustainability orientation, EMA and CSI are two important aspects where EMA assists companies in identifying and measuring the environmental impact of the company's operational activities, while CSI can assist companies in controlling and monitoring these operational activities to ensure that these activities are in accordance with the objectives of the company's sustainability orientation (Gibassier and Alcouffe, 2018; Latan et al., 2018; Gunarathne et al., 2021). However, to achieve the goal of an overall sustainability orientation, these two aspects need to be integrated and applied in certain sectors. Therefore, SGE can act as a mediation in linking EMA and CSI with sustainability orientation (Asiaei et al. (2022) applying EMA and CSI in certain sectors that are integrated with the

SGE concept, companies can achieve sustainability orientation objectives effectively and efficiently.

H4a: SGE mediates the relationship between EMA and sustainability orientation.

H4b: SGE mediates the relationship between CSI and sustainability orientation.

## 3. RESEARCH METHODS

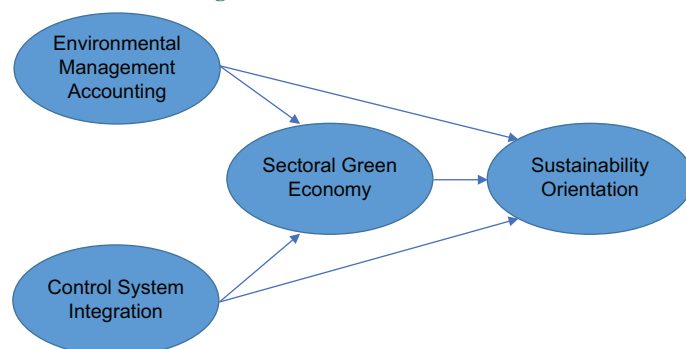
The research method used is a quantitative research method. This study uses a survey research design. The number of samples used in this study were 512 respondents. Respondents who were sampled were managers and employees of state-owned, mining and plantation companies in Indonesia. The sampling technique used was purposive sampling technique. The research instrument used was a questionnaire consisting of questions related to the independent variables, namely EMA and CSI, the dependent variable, namely sustainability orientation and the mediating variable, namely SGE (Figure 1). The measurement scale used is a Likert scale with a score range of 1-7. The collected data were then analyzed using SmartPLS software to test the research hypothesis and to test the effect of the independent variables on the mediating and dependent variables, and to test whether the SGE could mediate the relationship between EMA and CSI with sustainability orientation.

## 4. RESULTS

EMA and CSI are two important factors in achieving sustainability orientation in a company. EMA is an accounting system designed to help companies identify and measure the environmental impact of the company's operational activities. Meanwhile, CSI is a management system that allows companies to control and monitor the company's operational activities effectively. Integrating EMA and CSI and matching these two factors with SGE, where this concept aims to protect the environment to avoid environmental damage, companies can achieve a sustainability orientation by ensuring that their operational activities do not damage the environment and can be maintained in the long term.

The first analysis was carried out in order to find out whether each indicator of the latent variable used in this study has a good level of validity. The value of outer loadings can be said to be good if the value obtained from each latent variable indicator is higher

Figure 1: Theoretical framework





than 0.70. And outer loading values that are less than 0.70 should be considered for removal if possible.

The results of the analysis in Table 1 above show that the outer loading value obtained from each latent variable indicator used in this study is >0.70, even the average outer loading value obtained ranges from 0.80–0.90. This means that the indicators used in the latent variables in this study are acceptable.

Then, the next analysis test is the validity and reliability test. Validity test is used to determine the accuracy or accuracy of an instrument/questionnaire in measurement. While the reliability test is used to determine the consistency of the measuring instrument, whether the measuring device used is reliable and remains consistent if the measurement is repeated. The instrument/questionnaire can be said to be valid if the average variance extracted (AVE) value obtained is higher than 0.6, and it can be said to be reliable if the Cronbach's alpha value obtained is higher than 0.7.

The results of the validity and reliability tests in Table 2 above show that the Cronbach's alpha value is higher than 0.7, even three latent variables have a Cronbach's alpha value >0.9 and one latent variable has a Cronbach's alpha value >0.8. Therefore, the instrument/questionnaire used in this study is valid and acceptable. Then, the AVE value of all latent variables has a value in the range of 0.680–0.814, meaning that all latent variables in this study have an AVE value higher than 0.6. Thus, the consistency of the instrument/questionnaire which is an indicator of latent variables can be said to be consistent and reliable.

Furthermore, the R Square analysis test is used to determine how much the independent variable (exogenous) affects the dependent

variable (endogenous). Hair et al. (2011) the coefficient of determination and the significance level of the path coefficient (beta value) can be measured by R Square. R Square is a way to assess how much an endogenous construct can be explained by an exogenous construct. The closer the R Square value is to 1, the better the exogenous construct will be in explaining the endogenous construct. The R Square value >0.67 indicates that the model used is strong, the R Square value >0.33 indicates that the model is moderate and the R Square value 0.19–0.33 indicates that the model is weak (Ghozali and Latan, 2015).

From the results of R Square in Table 3 above, it can be seen that the R Square value obtained from the exogenous variables (EMA and CSI) on the green economy sectoral endogenous variables obtained a value of 0.374 and on the sustainability orientation variable of 0.338. That is, the structural model used in the study occupies a moderate position. Exogenous variables (EMA and CSI) are able to explain green economy sectoral endogenous variables by 37.4% and for endogen sustainability orientation variables by 33.8%, while the rest are explained by other variables not examined in this study.

Then, the model fit test is used to determine the goodness of the structural model used in the study. The model fit test was conducted to ensure that the model used can explain the patterns in the data properly and is in accordance with the proposed hypothesis. In assessing whether or not the model used in the study using the fit model test can be seen from the standardized root mean squared residual (SRMR) and normal fit index (NFI) values obtained. If the SRMR value is <0.10 and the NFI value obtained is closer to 1.0, the model used will be better or more appropriate.

From the results of the fit model test in Table 4 above, it shows that the SRMR value obtained is 0.062 and the NFI value obtained is

**Table 1: Outer loading**

Variable	Dimension	Outer loading value	Sample mean (M)	Standard deviation (STDEV)	T statistics ( O/STDEV )	P values
EMA	EMA1	0.823	0.821	0.033	25.086	0.000
	EMA2	0.819	0.822	0.027	30.617	0.000
	EMA3	0.880	0.883	0.017	50.479	0.000
	EMA4	0.766	0.760	0.054	14.047	0.000
	EMA5	0.833	0.832	0.043	19.506	0.000
CSI	CSI1	0.843	0.838	0.026	32.948	0.000
	CSI2	0.876	0.871	0.023	37.393	0.000
	CSI3	0.857	0.855	0.028	30.527	0.000
	CSI4	0.849	0.847	0.027	31.761	0.000
	CSI5	0.859	0.858	0.019	45.261	0.000
SGE	SGE1	0.905	0.904	0.014	63.030	0.000
	SGE2	0.957	0.957	0.007	140.647	0.000
	SGE3	0.897	0.896	0.017	53.762	0.000
	SGE4	0.822	0.818	0.030	27.360	0.000
	SGE5	0.925	0.925	0.012	78.680	0.000
SO	SO1	0.845	0.844	0.021	40.382	0.000
	SO2	0.887	0.882	0.022	39.871	0.000
	SO3	0.879	0.876	0.022	39.917	0.000
	SO4	0.910	0.911	0.013	70.923	0.000
	SO5	0.881	0.880	0.017	51.402	0.000

Source: Processed data (2023). EMA: Environmental management accounting, CSI: Control system integration, SGE: Sectoral green economy, SO: Sustainability orientation

0.863. The SRMR value is below 0.10 and the NFI value obtained is very good where the value is above 0.80 and is very close to 1.0. This means that the model used in this study is good and suitable.

#### 4.1. Hypothesis Testing

In this study there are four hypotheses where the first hypothesis states that: H1a. EMA influences SGE; and H1b. EMA influences sustainability orientation. Then the second hypothesis states: H2a. CSI affects SGE; and H2b. CSI affects the sustainability orientation. The third hypothesis states that: H3. SGE influences sustainability orientation. Then in the fourth hypothesis which uses a mediating

variable state that: H4a. SGE mediates the relationship between EMA and sustainability orientation; and H4b. SGE mediates the relationship between CSI and sustainability orientation.

To be able to find out whether the independent variable has a positive and significant effect on the dependent variable can be seen by using hypothesis testing directly and indirectly (Figure 2). The hypothesis can be accepted if the T statistics value obtained is higher than 1.96 and the P value obtained must be lower than 0.05. Test the hypothesis directly and indirectly can be seen in Tables 5 and 6 below:

**Table 2: Reliability and validity**

Variable	Cronbach's Alpha	rho_A	Composite reliability	AVE
EMA	0.883	0.912	0.914	0.680
CSI	0.910	0.917	0.932	0.734
SGE	0.942	0.944	0.956	0.814
SO	0.927	0.929	0.945	0.776

Source: Processed data (2023). EMA: Environmental management accounting, CSI: Control system integration, SGE: Sectoral green economy, AVE: Average variance extracted, SO: Sustainability orientation

**Table 3: R Square**

Variable	R Square	R Square adjusted
SGE	0.374	0.363
SO	0.338	0.330

Source: Processed data (2023). SO: Sustainability orientation

**Table 4: Fit summary**

Index	Saturated model	Estimated model
SRMR	0.062	0.062
d_ ULS	0.813	0.813
d_ G	0.410	0.410
Chi-Square	413.085	413.085
NFI	0.863	0.863

Source: Processed data (2023). SRMR: Standardized root mean squared residual

From the results of the hypothesis test on H1a, the T statistics value obtained was 2.373 and the P value obtained was 0.019. Therefore, it can be said that EMA has a positive and significant effect on the SGE. H1b obtained a T statistics value of 3.179 and a P value obtained of 0.002, thus EMA also has a significant influence on sustainability orientation. This is in line with research by Latan et al. (2018) and Zsóka and Vajkai (2018) which state that EMA helps businesses measure the environmental impact of their operations, enabling them to take action to reduce this impact and increase the efficiency of natural resource use.

Then in the second hypothesis, H2a obtains a T statistics value of 4,076 with a P value of 0,000. This means that CSI has a positive and significant effect on SGE. And on H2b, the T statistics value obtained is 6,289 with a P value of 0,000. Thus, the CSI also has a significant influence on sustainability orientation. The results of this study are consistent with the research of Ikram et al. (2019), the integration of control systems provides positive benefits for sustainability orientation in companies by helping companies unite sustainability goals, increase operational efficiency, reduce the environmental impact of company activities, and ensure company compliance with environmental regulations and international standards related to sustainability.

**Table 5: Direct effect**

Hypothesis	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics ( O/STDEV )	P values
H1a EMA -> SGE	0.127	0.130	0.054	2.373	0.019
H1b EMA -> SO	0.243	0.254	0.076	3.179	0.002
H2a CSI -> SGE	0.294	0.301	0.072	4.076	0.000
H2b CSI -> SO	0.446	0.442	0.071	6.289	0.000
H3 SO -> SGE	0.334	0.322	0.071	4.729	0.000

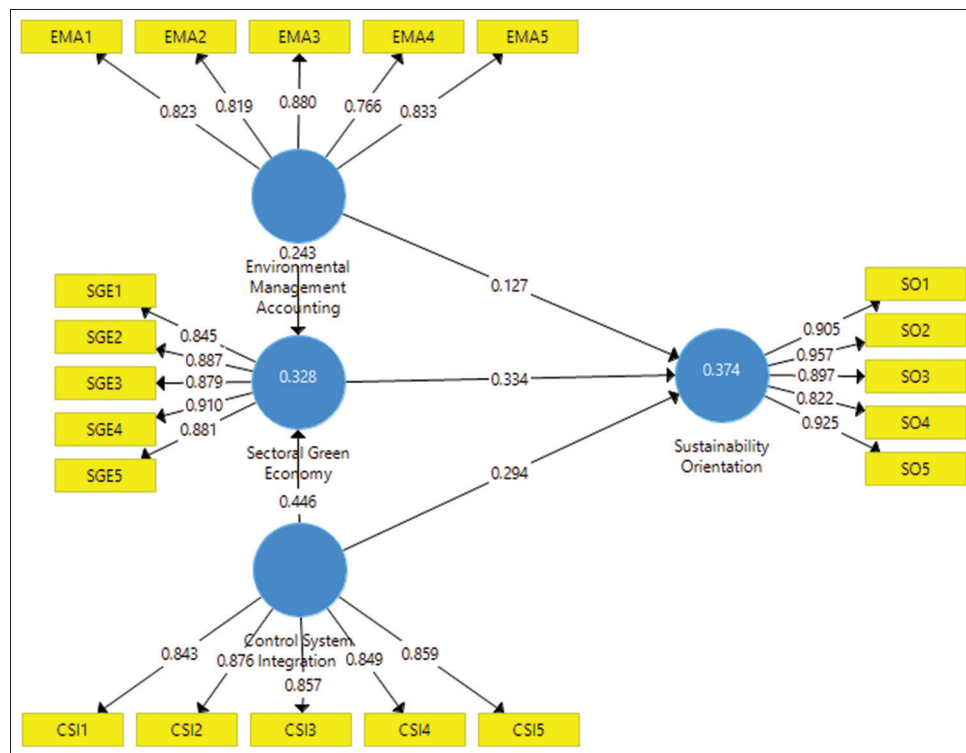
Source: Processed data (2023). EMA: Environmental management accounting, CSI: Control system integration, SGE: Sectoral green economy, AVE: Average variance extracted, SO: Sustainability orientation

**Table 6: Indirect effect**

Hypothesis	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics ( O/STDEV )	P values
H4a EMA -> SGE -> Sustainability Orientation	0.081	0.081	0.028	2.905	0.004
H4b CSI -> SGE -> Sustainability Orientation	0.149	0.143	0.042	3.574	0.000

Source: Processed data (2023). EMA: Environmental management accounting, CSI: Control system integration, SGE: Sectoral green economy, AVE: Average variance extracted

**Figure 2:** Construction of the SmartPLS Modeling Path Diagram



Furthermore, in the third hypothesis which states that the green economy sector has an effect on sustainability orientation, it obtains a T statistics value of 4,729 with a P value of 0,000. Therefore, H3 in this study can be accepted. The results of this study are in line with Knight (2017) that companies that rely mostly on natural resources must pay attention to aspects of environmental protection and preservation so that the activities carried out by companies do not cause damage to the environment.

And in the hypothesis that uses mediating variables, H4a obtains a T statistic value of 2.905 and a P value of 0.004 while H4b obtains a statistical T value of 3.574 with a P value of 0.000. Thus, it can be said that the SGE can be used as a good mediating factor in bridging the relationship between EMA and CSI towards sustainability orientation. This is in line with research by Asiaei et al. (2022) by implementing EMA and CSI in certain sectors that are integrated with the SGE concept, companies can achieve sustainability orientation objectives effectively and efficiently.

## 5. CONCLUSION

From the results of the research above, it can be concluded that the EMA and CSI variables have a significant effect on SGE and sustainability orientation. Then the SGE is also capable of being a good mediating factor in bridging the influence of EMA and CSI on sustainability orientation. Therefore, companies in their efforts to achieve long-term sustainability need to pay attention to these factors and integrate them properly in the company's management system. Paying attention to EMA which involves environmental aspects in the company's management accounting system will make it easier for managers to make decisions related to the environment which will have an impact on the company's

sustainability orientation. Then with the integration of control systems, companies can ensure that their operational activities do not damage the environment and can continue to run in a sustainable manner. Companies must also pay attention to SGE as a concept of sustainable economic development in certain sectors by taking into account environmental aspects. By applying this concept, companies can maintain a balance between economic activities and environmental preservation, so that a sustainability orientation can be achieved.

The implication of this research is that companies such as BUMN, mining and plantations in Indonesia need to pay attention to the importance of using EMA and CSI to achieve a sustainability orientation. In addition, SGE can also be used as a strategy to achieve a sustainability orientation. In the context of developing a green economy, SGE can be used as a basis for developing environmentally friendly sectors in the future. Thus, the integration of EMA, CSI, and SGE is important in achieving a sustainability orientation and maintaining the long-term sustainability of the company.

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