

# The Role of Green Technology to Identify Green Market Orientation and Green Performance: Implications for SME Open Innovation

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**Abstract.** The purpose of this study is to ascertain how green technology functions as a moderating factor between the influence of green market orientation and green performance, which includes both environmental and green economic performance. This study makes use of survey data from 157 SMEs. SEM-PLS was used to examine the hypothesis testing. This study demonstrates that the beneficial effects of a green market orientation on environmental performance can be mitigated by green technology. The impact of a green market orientation on the success of the green economy can also be mitigated by green technology. Based on the research findings, SMEs can enhance their cost efficiency by implementing green technology more extensively, which can decrease environmental effects and boost productivity. Applying sustainability principles is necessary for SMEs with a green market orientation to enhance their environmental performance

**Keywords:** Green Market Orientation, Environmental Performance, Green Economic Performance, Green Technology

## 1. Introduction

Companies have realized that, in order to improve operations and performance, they must incorporate environmental concerns into their strategic orientation due to the growing state of environmental degradation, the increasing rigor of rules and legislation, and the rising expectations of stakeholders and customers [35]. In order to meet the growing demands of stakeholders for sustainability, sustainability with a market-oriented perspective has been adopted [9].

Market orientation, which is linked to the acceptance of the marketing idea as a corporate philosophy, is an organizational culture that puts the demands of the customer first in order to build a long-term profitable company [14]. The implementation of market orientation can result in a competitive advantage through the creation of coordinating strategies, adaptable advantages, and an understanding of competitor actions and customer needs [13]. In other words, market orientation operationalizes the cultural foundation and applies it to development in order to create a competitive advantage through the use of corporate environment-adapted competitive strategies. According to Narver and Slater (1990), market orientation is the organizational culture that produces higher customer value and, consequently, long-term profitability in the most effective and efficient way. Even while being focused on the market is essential for a firm's performance, prior study has given. There is a dearth of empirical research on the connection between market orientation and corporate performance, as well as the effects of multidimensional market orientation [6] [38] [9].

Companies have the greatest using green technologies to create environmentally friendly goods in an effort to lessen the effects of their operations on the environment, but a new product may not flourish in the market without efficient communication and promotion. As a result, producers are attempting to place their favored product in the minds of their intended market so that, when making a selection, they will base it on the green factor. For instance, the detrimental impacts of plastic trash on the ocean have received a great deal of focus in recent times. The corporation overcame this obstacle by launching a significant campaign for this green innovation, which led to the market acceptance of the majority of their products.

It is clear from the literature that green market orientation, or GMO, improves company performance. In assessing the impact of genetically modified organisms (GMOs) on business performance [2] examined the influence of GMOs on green competitive advantage, and [38] also examined the impact of GMOs on firm performance. Although a great deal of research has been done on genetically modified organisms (GMOs), relatively little attention has been paid to how businesses might use GMOs to boost their ability to innovate or the success of newly released products. GMOs show how a business feels about growth, communication, and fewer environmentally harmful products and services [25].

Green market-focused businesses should invest in green technologies while developing new products. In this day and age, where environmental pressures and green consumerism are being evaluated, businesses that project a green image tend to draw in more business, particularly from consumers [28]. There are so more opportunities for innovative goods created by market-driven green manufacturing businesses to succeed in the marketplace. Additionally, manufacturing organizations are expected to advance their green innovation in order to achieve lowest environmental effect in product creation. This includes funding technological advancements that result in pollution, energy conservation, waste recycling, green product design, and corporate environmental management [5]. Using genetically modified organisms (GMOs) will safeguard the

corporation from lawsuits and complaints from environmental protection groups. It will affect the business's green technology as well by promoting efficient manufacturing and the growth of environmental markets [38]. Through better environmental management techniques, green technology assists manufacturing enterprises in meeting environmental criteria. As a result, green technology raises brand equity, or product value, which essentially represents the price of developing and providing environmentally friendly goods and services [30]. High-tech green manufacturing companies will have more productive resources, which will enable them to succeed in their ideas. However, the literature gives scant consideration to how green technology affects GMOs and the effectiveness of new product relationships.

Institutional theory states that for green market orientation methods to be legitimate, they must both promote profitable growth and add value to the environment and society [20]. The present study posits that the adoption of a market-oriented culture may have an impact on the intents of managers and employees to participate in sustainability-oriented behavior, with the goal of fulfilling the requirements of the market for sustainability. From this angle, businesses can enhance their performance [40] and acquire credibility by adopting a green market approach.

The way that businesses are addressing environmental concerns by adopting a green market orientation and using corporate innovation has garnered public attention recently [38] [29]. Investigating the connection between green market orientation and green performance within the context of moderator predictions is the goal of this study. We chose green technology to serve as a specific moderator within the context of practice and green performance. The primary tool for obtaining specific outcomes from environmental innovation is technology [10]. Technology is necessary for businesses to produce goods in an eco-friendly manner, consumers require high-quality goods at reasonable costs, and society needs a clean, safe environment for next generations [37]. But the initial outlay for technology is high, and producers must wait for a while to see a return on their investment [26]. Due to its high cost and significant investment requirements, the development and application of green technology can provide challenges for businesses. Hence, discussions regarding the expenses and advantages of implementing eco-friendly technology and infrastructure serve as a foundation for environmental innovation and business results [3] [36] [40].

With regard to green market orientation's moderating effect on green performance, that is, environmental and green economy performance, this study seeks to provide fresh insight into green technology in the context of East Java, Indonesia's industries. The writers also hope to have a deeper comprehension of the plans and regulations created to address the new issues surrounding sustainable growth of the economy and environment. Indonesia's industrial sector has the potential to grow. According to the Ministry of Industry's records, the manufacturing sector in 2020 was able to contribute significantly to the attainment of the IDR 216 trillion national investment value, or 26.7% of all investments realized in Indonesia during that year.

## **2. Literature Review And Hypothesis Development**

There are issues with business sustainability in a lot of nations worldwide. The three pillars of sustainable development are environmental, social, and economic [9]. The concept of sustainable development centers on fulfilling current demands without sacrificing those of future generations [38]. The Triple Bottom Line (TBL) concept operationalizes the company philosophy. The "simultaneous pursuit of economic prosperity, quality, and social justice" is what Elkington defines as TBL. To get sustainable success, companies need to take these three factors into account during the process. Therefore, businesses should prioritize their social and environmental duties in addition to their financial ones. Businesses will benefit financially, acquire a competitive edge, and improve their reputation by utilizing TBL [2].

### **2.1. Green Market Orientation on Green Performance**

An organizational strategy called "market orientation" is a very successful and efficient means of fostering the behaviors required to provide higher value and long-lasting superior performance for consumers. Businesses that are focused on the market will gather knowledge about consumer demands and rivals' actions, then combine it to produce greater value for their clients. The rise of environmentally conscious rivals and consumers has altered global concerns, making environmental issues more pressing [25]. Businesses must follow environmental principles while using resources, energy, and hazardous or toxic materials in order to achieve sustainable development. By emphasizing environmental responsibility, eco-friendly marketing initiatives seek to establish lasting connections with stakeholders and customers. Thus, in the age of environmental consciousness, market orientation is crucial to the accomplishment of business processes within an organization [9]

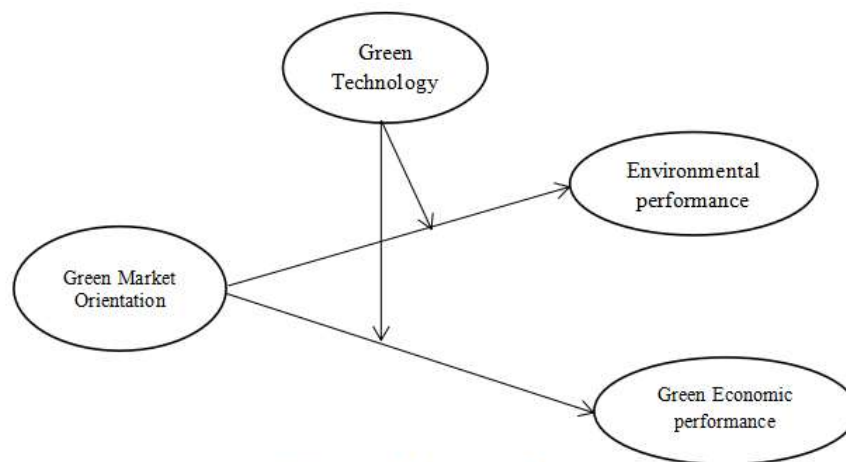
The impact of a green market orientation on business success has been demonstrated by numerous additional research. The study came to the same conclusion: a company's performance can be enhanced by implementing green market orientation more forcefully [14][34][18][22]. According to the findings [38], competitive advantage plays a part in enhancing mediated business performance, which is enhanced by green market orientation. However, according to study by Franmbach (2016), there are contextual elements that influence consumer decisions, therefore the concept of market orientation—that is, customer orientation—does not totally effect the company's success [27].

As was previously said, a GMO is an organizational culture that generates better customer value in the most effective and efficient way possible (Slater & Narver, 1994). Furthermore, it is defined by

Kohli and Jaworski (1990) as an organizational activity associated with the creation, integration, and responsiveness of market intelligence. In the past ten years, researchers from MO have frequently employed and blended the two definitions. In light of this, we define MO in this study as the organizational culture that, via the creation, assimilation, and application of market knowledge on customer wants and preferences, most effectively and efficiently generates greater customer value. Additionally, GMO researchers have long examined the effects of MO (Table 2). We divided the MO effects in this study into several categories, such as those related to corporate performance, customers, innovation, and employees. We also included one-fifth of the categories that were found to have environmental consequences, as Chen and Green et al. (2015) also advised.

This hypothesis is founded on the notion of legitimacy, which places particular emphasis on developing the capacity to adopt environmental practices to achieve environmental goals in order to gain a competitive advantage in the face of natural environmental limits (BalsandTate, 2018). Environmental performance increases as a result of green market orientation [2]

H1. Green market orientation is positively associated with environmental performance



**Figure 1.** Conceptual Framework

Businesses must implement ecologically friendly strategies if they want to improve their green business performance. A green marketing orientation approach can help businesses achieve better marketing and financial results, according to a study [7] that included 361 manufacturing enterprises in Europe. According to research conducted in Ghana by Amegbe et al., SMEs can perform better

in terms of customer satisfaction, employee retention, employee happiness, and image when they use a green marketing strategy [12]. Thus, a company's business performance increases with its level of green marketing focus. On the basis of the above claims, a second theory is put forth [2]

H2. Green Market Orientation practices are positively associated with operating green economic performance

### *2.2. The Moderating Role of Green Technology*

One type of technology diffusion that is crucial to the development of the global economy and environment is green technology. But the initial cost of technology is high, and businesses must wait for a while to see a return on their investment [31]. Due to its high cost and significant investment requirements, the development and application of green technology can provide challenges for businesses. Thus, discussions regarding the advantages and disadvantages of implementing eco-friendly infrastructure and technologies serve to promote both corporate outcomes and environmental innovation [16][8].

Whether or not these advantages are economically justified depends on a number of factors, including costs, benefits, technological know-how, and available resources. Project management empirical study [24] demonstrates that people are unable to weigh all the advantages and disadvantages while making decisions. Research employing engineering data frequently reveal that ostensibly economical green investments are not being made [3]. Global carbon monoxide emissions cannot now be decreased by investing in ecologically benign and reasonably priced technologies, as claimed by McKinsey & Company (2009) [40]

H3. The relationship between Green market orientation and environmental performance is stronger when a firm has green technology

H4. The relationship between Green market orientation and green economic performance is stronger when a firm has green technology

## **3. Research Method**

This kind of research aims to determine the relationship between numerous scientific variables through the use of a quantitative technique. This work uses a quantitative research design, which has the benefit of using population and statistical tools to produce changes in natural populations [33]. The connections under consideration are either patterns of interconnections or links resulting from direct or indirect interactions between the several study variables. This study's pattern of relationships between its many variables aims to test hypotheses and draw findings to evaluate the relationship model. The goal of quantitative research is to provide an explanation for a phenomenon by gathering data and analyzing it using statistical or mathematical techniques [15].

### **3.1. Sample**

There were 5,675 SME industrial enterprises in East Java, according to data from the province's Central Statistics Agency in 2021. Only 283 businesses, nevertheless, have adopted green business practices. To choose the study's sample, the author used random sampling.

### **3.2. Data Analysis**

The quantitative approach's findings are derived from questionnaires that are restricted to numerical data, statistics, measuring data, and different types of statistical analysis. This study's framework, quantitative research design, enables researchers to assess the sample of respondents' opinions regarding the phenomenon under investigation as a whole. In this instance, the primary research tool used by the researcher to ascertain the function of green technology factors in determining the association between green market orientation with environmental performance and green economy performance is a questionnaire. The association between variables that were created in accordance with the goals, issues, and research hypotheses was examined using questionnaires. Survey-derived data is imported into Smart-PLS for analysis [1]. Because PLS-SEM can handle relatively small sample sizes, process multiple independent and simultaneous variables, examine mediating associations, and address multicollinearity issues, it is seen to be appropriate [2]

### **3.3. Measurement**

A self-administered questionnaire was created for the purpose of gathering data. It was broken up into two sections: measuring items that were modified from earlier studies and questions on the demographics of the participants in the second section. Table I provided an overview of the measurement elements' specifics. There are four variables in this study: green market orientation (Knowledge of environmentally friendly customers determines competitive advantage; customer pleasure with environmentally friendly customers) [4]; Environmental performance includes information about green products and services, customer-oriented knowledge about the environment, and investments in green products and services relative to competitors. Green economic performance includes cost reduction and resource management efficiency. Green technology includes cost and benefit analysis, payback period, and company capability. All measurement items are on a five-point Likert scale, starting from 1: Strongly Disagree to 5: Strongly Agree.

Table 1. Measures		
Variable	Number of items	Source
Green Market Orientation (GMO)	8	Fraj et al., 2011; Tjahjadi et al., 2020
Environmental performance (EP)	6	Causins et al, 2019
Green Economic Performance (GEP)	8	Cankaya et al., 2019; Mehdikani, 2019
Green Technology (GT)	7	Allan, et al., 2014; Kong, et. Al 2016

#### 4. Results And Discussion

Purposive sampling was the method of sampling that was applied. Approximately 283 questionnaires were sent to East Java, Indonesia, manufacturing enterprises in the first quarter of 2020. Following calculations, the study's ultimate sample size was 157 responses, or 55% of the total. According to the rule technique, the sample size for the current study satisfied the minimal sample size requirement. The process that was used to determine the general method's bias was covered by MacKenzie and Podsakoff (2012), particularly when it came to creating the questionnaire and distributing it to the respondents. [23].

Right now, SEM-PLS is a potent method for examining social issue data. SEM-PLS, an improved version of multiple regression, is a two-step equation. Two assessments—an external model assessment and an internal model assessment—evidence this. Evaluating the model's validity and dependability is the initial stage. In SmartPLS, once validity and reliability data for each construct have been obtained, hypotheses must be tested using structural model testing. Testing hypotheses comes in second [32].

If an indicator for a variable has a loading factor, Average Variance Extracted (AVE), composite reliability values of more than 0.5 ( $> 0.5$ ); 0.5 ( $> 0.5$ ); or 0.7 ( $> 0.7$ ), it is deemed genuine and significant [15]. All of the indicators in Table 2 satisfy the aforementioned criteria. It is possible to conclude that each block item in the table corresponds to its corresponding construct size because the composite reliability values are good over 0.7. This indicates that the validity and reliability tests for this research have been passed. in order to do the following test.



**Table 2.** Validity and Reliability

Variable	Measures	Outer loading	Comp. Reliability	AVE
GMO	GMO1	0.828	0.921	0.629
	GMO2	0.889		
	GMO3	0.894		
	GMO4	0.927		
	GMO5	0.867		
	GMO6	0.879		
	GMO7	0.947		
	GMO8	0.760		
EP	EP1	0.666	0.869	0.531
	EP2	0.927		
	EP3	0.867		
	EP4	0.709		
	EP5	0.890		
	EP6	0.760		
GEP	GEP1	0.666	0.869	0.531
	GEP2	0.927		
	GEP3	0.690		
	GEP4	0.760		
	GEP5	0.767		
	GEP6	0.709		
	GEP7	0.686		
	GEP8	0.670		
GT	GT1	0.925	0.921	0.629
	GT2	0.841		
	GT3	0.792		
	GT4	0.837		
	GT5	0.820		
	GT6	0.742		
	GT7	0.734		

Stated differently, the results of this investigation demonstrate that convergent validity is met. Composite reliability, factor loading, and reliability analysis can all be used to verify convergent validity. Moreover, AVE was investigated as one of the helpful metrics for validating claims [15]. Since it is possible to determine that these variables—the mediating variable and the dependent variable—have a strong correlation with one another in the parent factor by examining convergent validity.

Testing the relationship between reflective factors and indicators starts with discriminatory validity. discriminant validity measured using cross-loading and the Fornell-Larcker postulate. Latent variables share more variation with the underlying indicator than with other latent variables, according to the Fornell-Larcker postulate. According to statistics, each latent variable's AVE value needs to be higher than the highest R square value obtained from the values of the other latent variables. The second criterion for discriminant validity is “loading”, for each indicator it is expected to be higher than “cross-loading” (), as mentioned in Table 3.

**Table 3.** Discriminant Validity

Variable	1	2	3	4
EP	0.758			
GEP	0.584	0.796		
GMO	0.830	0.796	0.808	
GT	0.871	0.796	0.876	0.793

As previously mentioned, the following stage is to access the structural relationships between variables after reviewing the conceptual model's measurement, or, to put it another way, after evaluating the instrument's validity and reliability. SEM-PLS has an advantage over other statistical methods in that it analyzes all structural associations at once [34]. As a result, both direct and indirect impacts were investigated. In order to investigate mediation in structural equation modeling, indirect effects were looked at. If the t-value is more than 1.96 and the p-value is less than 0.05 (the 5% significance level), the association is considered significant in data analysis.

**Table 5.** Hypotheses testing

No	Hypotheses	( $\beta$ )		T Statistics	P Values
H1	GMO -> EP	0.435	0.185	2,268	0.021
H2	GMO -> GEP	0.457	0.157	3,190	0.003
H3	Moderating Effect 1 -> EP	0.417	0.191	2,258	0.035
H4	Moderating Effect 1 -> GEP	0.432	0,387	3,151	0.003

Table 5 demonstrates that Green Market Orientation (GMO) has a significant and positive effect on environmental performance (EP), with a p-value of 0.021 and a path coefficient of 0.435. This coefficient indicates that as Green Market Orientation (GMO) rises, EP will as well. The results of the hypothesis test indicate that H1 was accepted. Furthermore, there is a significant and positive correlation between GMO and green economic performance (GEP), with a p-value of 0.003 and a path coefficient of 0.457. This coefficient indicates that as green market orientation (GMO) rises, so will green economic performance (GEP). The results of the hypothesis test show that H2 was accepted.

With a p-value of 0.035 and a path coefficient of 0.417, hypothesis testing of the moderating influence of green technology (GT) can bolster the positive association between green market orientation (GMO) and environmental performance (EP). This coefficient suggests that the association between GMO and environmental performance (EP) will be further strengthened by improved green technology (GT). The hypothesis test's outcome indicates that H3 is accepted. With a p-value of 0.003 and a path coefficient of 0.432, the moderating influence of green technology (GT) can enhance the correlation between green market orientation (GMO) and green economic performance (GEP). The coefficient exhibits a positive outcome, indicating that further adoption of green technology (GT) by laborers will reinforce the correlation between environmental performance (EP) and green market orientation (GMO). The hypothesis test's findings indicate that H4 is acceptable.

## **5. Conclusion**

### **5.1. Conclusion**

We investigate how market orientation and green performance—that is, environmental and green economy performance—are directly related. The test findings demonstrate that green performance, or the performance of the environment and the green economy, is positively and significantly impacted by the green market orientation. These findings suggest that green performance (environment and green economic performance) increases with increasing green market orientation.

The positive correlation between green market orientation and environmental performance can be reinforced by the moderating effect of green technology. A company's environmental performance in a green market orientation will increase with greater adoption and use of green technology within the organization. Green market orientation and green economy success may be correlated less strongly in the interim due to the moderating influence of green technology. This demonstrates that the correlation between green market orientation and green economic performance is weakened the more environmentally friendly technology methods are used.

## 5.2. Discussion for Open Innovation in SME's

There is evidence to support the first and second hypotheses, which contend that a green market orientation improves both environmental and green economic performance. According to the sustainability hypothesis, in order for businesses to function sustainably, they must address the issue of environmental awareness. If used effectively, green market orientation as a marketing tactic will enhance green performance. The study's findings support the sustainability theory and offer more empirical support for earlier research [21]. In order to improve the green performance of SMEs in the province of East Java, this study highlights the significance of a green market orientation strategy. To enhance their green performance, small and medium-sized enterprises (SMEs) with a focus on the green market must include the concept of sustainability into their operations. Therefore, green performance will increase with the quality of a green market orientation's implementation.

There is additional support for the third hypothesis, which claims that green technology mitigates the impact of green market orientation on environmental performance. In the context of the study of Indonesian SMEs, these findings support and give empirical support to the theories of sustainability and entrepreneurship. The process by which green market orientation influences environmental performance through the implementation of green technology is also better understood by the owners/managers of SMEs in East Java as a result of this study. The moderating function of green technology in the relationship between environmental performance and green market orientation is persuaded to SMEs' owners and managers by this study. As a result, it's critical to advance green technology and procedures, satisfy green customers' demands, and outbid green rivals.

Adopting green technologies and successfully implementing them is a more significant differentiation in the sustainability and value proposition for small and medium-sized enterprises, particularly those that are up against fierce competition. Thus, knowledge of the green market orientations that could result in the adoption of technology is related to the development of green performance and strategies [31]. The fourth hypothesis's findings demonstrate that, when green technology is moderated, a green market orientation has a detrimental impact on green economic performance. The business community's recent focus on environmental challenges through green market orientation and commercial innovation has garnered public attention [17]. Technology advancements fuel green innovation methods [39].

Researchers had long acknowledged the critical role that technology played in making green market orientation easier to implement before the environmental movement. The general aspects pertain to the goals, procedures, and assistance associated with the potential for business innovation, with the aim of enhancing firm performance within the green market through the implementation of green

technology. However, producers must wait a while to see a return on their investment because to the substantial initial cost of the technology [26]. Due to the high cost and significant investment required for technology utilization, the creation and application of such technology may present challenges for businesses [3]. Furthermore, the energy industry needs to provide proper green market orientation and minimize the environmental impacts of energy in order to contribute to sustainable development [20] [19]. All companies whose benefits exceed their costs are assumed to adopt at any given time, if they haven't already. It follows that there will be a useful life limit, beyond which no company will adopt (or will adopt later) and all enterprises whose advantages fall short of this threshold will not adopt. Although it is a bit expensive at first, the price will eventually decrease. With every cut in expenses, more businesses are learning about intriguing new technologies.

According to earlier studies, long-term green marketing strategies can produce assets, profits, and cash flow [11]. However, long-term investment costs and benefits must also be considered, as well as time horizons and time levels. Adoption of environmentally friendly technology happens only when desirable or necessary externalities are reduced, as some of these technologies come with new capital expenses and increasing operating costs for consumers [3]. In other instances, the lower load is caused by the utilization of materials and/or energy inputs that are more efficient, which lowers operational costs. Thus, some studies and public lobbying argue that cost efficiencies should be achieved by implementing current technology more widely, as this will lessen their negative effects on the environment and save money, especially for small businesses [29].

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