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Article

The role of green sustainable innovation as a mediator of the relationship between green market orientation and competitive advantage: Insights from Saudi Arabia

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Abstract: This study explored the relationships between green market orientation and competitive advantage, with a particular focus on the mediating role of green sustainable innovation. The research utilized a structured questionnaire to gather data from managers involved in environmental protection and professionals working in the manufacturing sectors of computers, electronics, optical products, and electrical equipment. The survey targeted respondents from key regions in Saudi Arabia, including Riyadh, Qassim, and the Eastern Province, resulting in a total of 273 responses. The collected data were analyzed using structural equation modeling (SEM), a robust statistical technique that allows for the examination of complex relationships between variables. The findings confirmed a mediational model where green sustainable innovation—comprising both green product and green process innovation—served as a critical intermediary linking green market orientation to competitive advantage. Furthermore, the study validated direct effects of green market orientation on both green sustainable innovation and competitive advantage. These results emphasize the dual pathways through which green market orientation influences business performance. The research concludes by offering actionable insights for Saudi managers, highlighting strategies to maximize profitability and competitiveness through the adoption and implementation of green sustainable innovation practices.

Keywords: green sustainable innovation; green marketing; competitive advantage; green customer orientation; green inter-functional orientation; green competitor

1. Introduction

Nowadays, companies are more conscious about the effects of changes in the natural environment and the crucial importance of global sustainability (Patari et al., 2016). Several studies have examined the importance of environmental issues including pollution, deforestation, ozone layer depletion, biodiversity loss, global warming, and garbage disposal (Robertson and Barling, 2017). In fact, it appears that environmental consequences caused by the traditional consumption and production push the firms to focus on their innovative strategies to adopt green approach in terms of clean design or green production including product repurposing, recycling, reuse and low-carbon emission (Kautish and Sharma, 2019; Moreau et al., 2017). A growing body of literature show that the traditional consumption and production within developing economies is one of the major causes of environmental challenges because the percentage of consumption and production tends to be relatively high in these countries. Hence, it seems an urgent need to balance the ecological conservation and environmental protection (Kautish and Sharma, 2019). In the contemporary circular

economy, green investment and marketing are essential for sustainable manufacturing and corporate performance (Jinru et al., 2022). That said, authors examined the association between corporate environmental strategy and firm competitiveness and underlined a significant impact in the context of contemporary businesses (Papadas et al., 2019). Researchers have studied how green marketing can positively impact business performance by improving marketing activities, in industries with a focus, on environmental sustainability (Mukonza and Swarts, 2020). However, the marketing literature indicated a gap in the field of green market orientation and how it maximises firms' competitiveness (Banerjee, 2017). In fact, recent studies reported some hesitancy towards using the green market orientation that leads to a poor engagement of some companies regarding sustainable business practices, and intensifies the risks and losses (Papadas et al., 2017). Moreover, some authors reported the fact that investment into green market orientation and green innovation strategies tends to be high and will have a negative impact on the company's financial performance (Hales et al., 2016; Zhang and Berhe, 2022). Given all of this, many countries have implemented new policies and reforms under environmental regulation policies in order to guide stakeholders to take necessary measures and became aware of environmental degradation (Awan et al., 2021).

As specialists have begun to address challenges posed by raised green market orientation and innovation sustainability, a growing number of studies shown a connection between market orientation and how well an organization performs (Joseph and Francis, 2015; Wang, 2020; Yaprak et al., 2015). Other researchers have stressed the importance of green sustainable innovation and concentrated on internal factors (e.g., organizational green culture technical push, corporate profitability) or external factors (e.g., policy regulations, consumer demands, etc.…) (Doran and Ryan, 2016; Kesidou and Demirel, 2012; Wang, 2020). Several crucial gaps remain in existing knowledge especially in the Saudi industry. For instance, the relationship between green market orientation and competitive advantage remains underexplored. Researchers examining this connection have emphasized the significance of green innovation in the context of green market orientation (Menguc and Ozanne, 2005). While most of these studies have focused on these variables independently, the analysis of how the three components of green market orientation relate to CA is scanty. Secondly, although existing literature has largely explored the direct effect of market orientation on business performance (e.g., Nwokah, 2008; Zhou et al., 2008), details are not clear with regard to how the dimensions of GMR affect CA, especially when GSI acts as a mediator.

Several crucial gaps remain in existing knowledge especially in the Saudi industry. For instance, the relationship between green market orientation and competitive advantage remains underexplored. Researchers examining this connection have emphasized the significance of green innovation in the context of green market orientation (Menguc and Ozanne, 2005). Most of these studies have examined these variables independently, with limited research addressing how the three components of green market orientation relate to competitive advantage. Additionally, while existing studies largely explore the direct impact of market orientation on business performance (e.g., Nwokah, 2008; Zhou et al., 2008), there is little insight into how

green market orientation influences competitive advantage, particularly when mediated by green sustainable innovation.

Examining such association, Saudi Arabia appears as one of the countries that has a great awareness about the importance of environment and encourage the sustainability. The KSA's 1st Voluntary National Review "Towards Saudi Arabia's Sustainable Tomorrow," which was submitted to the UN High-Level Political Forum in New York on 9–18 July 2018, stated that sustainable development goal No. 13 pointed out the climate change as a major global challenge of the twenty-first century with far-reaching long-term effects on Earth's ecosystems (1st Voluntary National Review, n.d.). In order to achieve its objectives, which include using renewable energy sources and creating green buildings, the KSA has encouraged the use of green innovation in order to reduce resource consumption, preventing environmental contamination, improving industrial processes, and implementing environmental management systems (Wasiq et al., 2023). Given all of this, our research question can be formulated as follow:

In the Saudi context, how does the connection between green Market orientation and the competitive advantage can be mediated by green sustainable innovation?

This study aims to fill the knowledge gap in the literature by investigating the importance of green market orientation and its impacts on green sustainable innovation and competitive advantage. Furthermore, this study is one of the few that looks at the concept of green sustainable innovation for Saudi companies.

This article will be organized as follow: Section 2 is devoted to the literature review and hypotheses development. Section 3 is devoted to the methodology used. Section 4 highlights the exploration of the empirical findings. The discussion, conclusion and recommendations are involved in Section 5.

2. Literature review and hypotheses development

2.1. Green market orientation GMO

A growing body of literature defines green marketing as a management process in which firms fulfill their responsibility to identify, anticipate, and satisfy the needs of both customers and society in a sustainable and profitable manner (Chung, 2020). Within this context, green marketing orientation (GMO) comprises two primary components. First, businesses must meet consumer needs while minimizing their environmental impact. Second, the quality of products must align with a strong commitment to environmental sustainability (Papadas et al., 2017).

Green marketing, therefore, adopts a strategic and long-term approach. It involves focusing on corporate environmental strategies, engaging with external environmental stakeholders, and implementing proactive environmental measures (Wang, 2019). According to Wang, integrating green approaches and values into a firm's corporate-level strategy serves as a response to address the challenges and risks posed by traditional marketing orientations and operations to the environment. These strategies not only contribute to environmental sustainability but also support profit maximization, increased sales, and enhanced competitiveness for businesses (Choudhury et al., 2019; Vilkaite-Vaitone and Skackauskiene, 2020).

From this perspective, many scholars emphasize the role of competitive pressures in driving large businesses to adopt environmental marketing strategies such as green market orientation (GMO). GMO, a specific type of market orientation, is frequently referenced in marketing research (Li et al., 2018; Zaki et al., 2022) as a framework that helps organizations deliver greater value to their customers (Kohli and Jaworski, 1990; Narver and Slater, 1990). In an era of heightened environmental awareness, GMO has become integral to the success of corporate activities (Moravcikova et al., 2017). Organizations prioritizing GMO aim to remain competitive in increasingly aggressive markets by adopting green marketing strategies that offer environmentally friendly solutions (D'Souza et al., 2015).

The existing literature on market orientation highlights that adopting GMO enhances corporate greening and facilitates the delivery of eco-friendly products to customers (Chen et al., 2015; Crittenden et al., 2011). GMO benefits organizations by strengthening their distinct capabilities to achieve ecological objectives. Firms leveraging GMO not only enhance their environmental performance but also solidify their competitive advantage by meeting the growing demand for sustainable products and practices.

2.2. Green sustainable innovation

Over the last decade, green innovation has been widely recognized as a key element of environmental sustainability, encompassing both environmental and ecological innovation (Carrillo-Hermosilla et al., 2010). Green or ecological innovation has become a strategic priority for corporations due to increasing pressure to minimize the adverse environmental impact of their operations while enhancing competitiveness (Wang and Yang, 2021; Wasiq et al., 2023; Winston et al., 2017). Demirel and Kesidou (2019) emphasize the role of government in fostering green innovation through environmental regulations and incentives designed to encourage environmentally friendly practices among companies. Building on Schumpeter's Theory of Innovation, Li et al. (2020) describe innovation as the process of generating new ideas to improve how tasks are accomplished. This approach enables firms to build competitive advantages while achieving technological, societal, and economic progress, ultimately contributing to economic growth. On the other hand, some scholars have applied the Innovation Diffusion Theory (IDT) to examine the adoption of green innovation. This perspective focuses on how environmental, technological, and organizational factors influence companies' ability to adopt green practices, helping them maintain a strong position in the market and reduce their environmental footprint (Ferreira et al., 2020; Hue, 2019; Hwang et al., 2016). The literature reveals a growing body of research on green innovation (Carrillo-Hermosilla et al., 2010; Li et al., 2020; Martín-de Castro et al., 2016; Wu et al., 2018) and green sustainable innovation (Chang, 2020; Chen et al., 2006; Kamboj and Rahman, 2017; Ozaki, 2011). The terms ecological innovation, sustainable innovation, and environmental innovation are often used interchangeably, depending on the type of innovation being discussed (Roh et al., 2023; Schiederig et al., 2012). Green innovation serves as an umbrella term encompassing innovations that prioritize environmental management systems, green product design, energy conservation, waste reduction, pollution

prevention, and recycling (Eiadat et al., 2008). This overlap in terminology explains the use of these concepts as synonyms across the literature (Leal-Millan et al., 2017).

Green innovation can be classified as either incremental or radical and encompasses innovations in processes, organizations, and products aimed at reducing environmental impacts. Such innovations contribute to reducing pollution while enhancing firms' competitiveness, aligning business goals with societal welfare (Ardyan et al., 2017; Demirel and Kesidou, 2019; Nanath and Pillai, 2017; Zubeltzu-Jaka et al., 2018). From a broader perspective, sustainable innovation represents a transformative shift in practices, products, and even mindsets and beliefs. Its ultimate goal is to create value across social, economic, and environmental dimensions (Adams et al., 2016). Multiple studies document that green sustainable innovation integrates green product and process innovations (Chang, 2011; Chen et al., 2006). Examples include technological advancements in waste recycling, pollution prevention, energy conservation, green product design, and corporate environmental management. For the purpose of this study, the definition of green sustainable innovation proposed by Chen et al. (2006) is adopted, which encompasses a comprehensive approach to achieving sustainability through technological and organizational improvements.

2.3. Competitive advantage

The concept of competitive advantage has been extensively studied within both economics and strategic management (Leiblein, 2011). Numerous scholars have explored the various determinants of competitive advantage, contributing to a rich and diverse body of literature (Barney, 1991, 1986; Dierickx and Cool, 1989; Digdowiseiso and Lestari, 2021; Eisenhardt and Martin, 2000; Mornah and McDermott, 2016; O'Regan and Ghobadian, 2004; Porter, 1985; Schiefer and Hartmann, 2008; Teece et al., 1997). Despite the wealth of research, achieving consensus on a single definition of competitive advantage remains challenging due to its inherent complexity and multidimensional nature. Sigalas et al. (2013) highlighted this difficulty, noting that competitive advantage can be understood either through its outcomes—such as superior performance (Besanko et al., 2000; Foss and Knudsen, 2003; Ghemawat, 1991; Grahovac and Miller, 2009; Grant, 1998; Raharjo, 2019; Schoemaker, 1990; Winter, 1995)—or its underlying determinants (Powell, 2002; Wiggins and Ruefli, 2002).

One widely accepted interpretation, however, frames competitive advantage as the unique position a company achieves when it successfully implements a strategy that competitors cannot easily replicate. This niche position allows the company to maintain a sustainable edge in the market (Chang, 2011; Porter, 1980; Porter and van der Linde, 1995). Among the many definitions proposed, perhaps the most influential is that of Porter (1985) who described competitive advantage as a company's ability to deliver greater value to its customers than its competitors. This added value can take the form of lower costs, superior quality, or unique features, which in turn provide consumers with greater benefits and ultimately drive profitability for the firm.

2.4. Hypotheses and research model

2.4.1. Green sustainable innovation and GMO

Prior research has established that innovation often serves as a precursor to market orientation in general (Beck et al., 2011; Block et al., 2016; Nasution et al., 2011). Companies' efforts to engage in green innovation are frequently driven by customer preferences for environmentally friendly products, highlighting the critical role of the demand-pull factor in stimulating the creation of new products (Kesidou and Demirel, 2012). This consumer-driven orientation encourages firms to develop innovative solutions that meet environmental expectations while ensuring the sustainability of their industries. A green consumer orientation allows companies to capture fresh ideas from the market, facilitating the alignment of their offerings with customers' environmental values (Lukas and Ferrell, 2000; Sarkar, 2012). However, businesses cannot effectively choose green innovation strategies to protect and enhance their competitive position without a clear understanding of their competitors' environmental strategies. Companies that adopt a green competitor orientation tend to exhibit greater innovation when addressing environmental challenges (Wang, 2020).

The literature further demonstrates that green market orientation (GMO) positively influences green innovation (Borazon et al., 2022; Wang, 2020). Building on the foundational work of Narver and Slater (1990), who conceptualized market orientation as comprising three components, we extend this framework to GMO. The three key components of GMO are green customer orientation that focusing on understanding and addressing the environmental expectations of customers, green interfunctional orientation that ensuring that internal functions are aligned toward achieving environmental goals, and green competitor orientation that monitoring and responding to competitors' environmental strategies. In light of these theoretical underpinnings and prior contributions, we propose the following hypotheses to further explore the relationship between GMO and green innovation:

H1a. Green customer orientation has a positive effect on green sustainable innovation.

H1b. Green interfunctional orientation has a positive effect on green sustainable innovation.

H1c. Green competitor orientation has a positive effect on green sustainable innovation.

2.4.2. Green sustainable innovation and competitive advantage

Over the past few decades, companies have increasingly recognized the necessity of developing green products and green processes that are both sustainable and competitive. Such efforts are essential for enhancing productivity and maintaining a competitive edge in the marketplace (Chen et al., 2006; Liu et al., 2014). The literature highlights numerous studies emphasizing the dual benefits of green innovation: reducing the negative environmental impact of business operations while simultaneously strengthening the company's competitive advantage (Borsatto and Amui, 2019; Chen et al., 2006; Chiou et al., 2011; Klassen and Whybark, 1999; Porter and Van der Linde, 1995; Rao, 2002; Sellitto et al., 2020; Tu and Wu, 2020; Yin et al., 2020). Many of these studies adopt a resource-based view (RBV) to explain the relationship between green innovation and competitive advantage. The RBV suggests that firms' internal resources, including innovative capabilities, are key drivers of sustainable competitive advantages (Tu and Wu, 2020). Green innovation, in

particular, leverages organizational resources to develop eco-friendly processes and products that align with environmental goals while providing market differentiation. As discussed in earlier sections, green innovation predominantly comprises two dimensions: green process innovation and green product innovation (Chen et al., 2006; Chiou et al., 2011; Hart, 1995; Klassen and Whybark, 1999; Porter and Van der Linde, 1995; Schmidheiny and Timberlake, 1992). Green process innovation involves improving operational practices to reduce environmental impact, while green product innovation focuses on developing sustainable products that meet consumer demands for environmentally friendly options. Given this understanding, the second hypothesis of this research can be stated as follows:

H2a: Innovation in green products has a positive influence on competitive advantage.

H2b: Innovation in green process has a positive influence on competitive advantage.

2.4.3. GMO and competitive advantage

Green market orientation (GMO) is widely recognized as an intangible resource critical for the profitable development and maintenance of competitive advantage and customer value (Ketchen et al., 2007; Lawson and Samson, 2001; Slater and Narver, 1995). Drawing from a natural-resource-based view (NRBV), it is evident that organizations can enhance their resources and capabilities to support sustainability initiatives, protect the environment, and strengthen their competitive positioning (Hart, 1995). Empirical studies consistently demonstrate the positive relationship between green sustainable innovation, GMO, and competitive advantage (Chen et al., 2006; Leonidou et al., 2015; Papadas et al., 2019). This connection underscores the strategic importance of integrating green practices into business operations to achieve long-term success. Scholars have extensively explored the role of GMO as a determinant of competitive advantage, often positioning it as an antecedent to firm performance (Ngo, 2022; Nuryakin and Maryati, 2022; Tjahjadi et al., 2020; Wang, 2020). Considering this empirical and theoretical foundation, Hypothesis 3 is proposed as follows:

H3: The GMO has a positive influence on competitive advantage

2.4.4. The mediating effect of green sustainable innovation

The literature widely acknowledges that innovation is a key driver of competitive advantage (Porter and Van der Linde, 1995). As discussed in previous sections, the growing awareness of green consumption among consumers has significantly increased the social and environmental responsibilities of companies (Tjahjadi et al., 2020). In response, an increasing number of businesses are adopting green product and green process innovations to meet the demands of environmentally conscious customers while mitigating the negative environmental impacts of their manufacturing operations. Implementing green innovation has become indispensable for businesses seeking to navigate regulatory requirements, withstand competitive pressures, and address evolving customer expectations. Companies that integrate green innovation into their strategies can better align with sustainability goals while enhancing their market resilience (Lin et al., 2014). Building on the findings of Tjahjadi et al. (2020), we propose the following hypothesis:

H4. Green product innovation(a) and green process innovation(b) would mediate the effect of (i) green customer orientation, (ii) green interfunctional orientation, (iii) green competitor orientation on competitive advantage

Hence, our research framework will be shown on the **Figure 1** below.

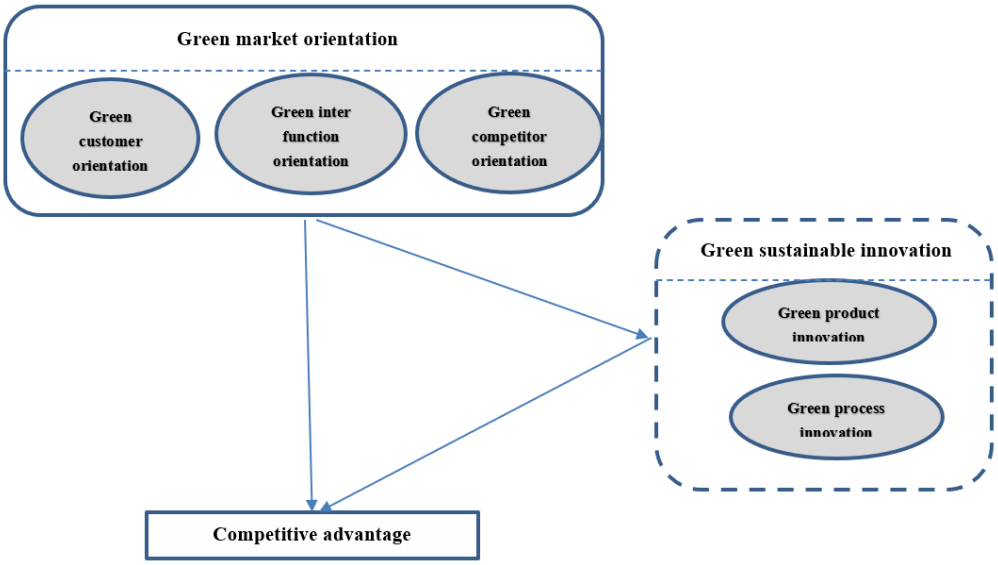

Figure 1. Research model.

3. Method

Based on a quantitative study, our research aims to explore how competitive advantage is impacted by a green market orientation. In order to better define our sample, a random sampling technique was adopted. First, we identified the industries most involved in green innovation. In fact, it seems that high-tech firms are more likely to introduce green innovation compared to traditional low-tech industries. For this, we referred to the list pre-established by the national industrial information center (https://fd.niic.gov.sa/). Groups were already defined. The data was gathered from Saudi manufacturers of computer, electronic, optical products and electrical equipment in Riyadh, Qassim and Eastern region. The total number of companies in these regions was 357 companies. We opted for a survey for the data collection. Chief executive officers and managers in charge of marketing, production, human resources, environmental protection, and R&D at Saudi manufacturing enterprises were contacted by email. The choice of this data collection method allows us to reduce the costs of the survey and to have quickly answer.

Extant literature has examined various factors affecting the sample size when we opt for structural equation modeling. Hoyle and Gottfredson (2015) argued that the sample should be representative leading to rules of thumb widely known based on the ratio of participants to variables—10:1. These authors indicated that the correct sample size needed for SEM is from 30 to 460. Given all of that, our sample size was 357 participants (one participant from each company already identified).

A pilot study of 35 respondents from the Eastern region was conducted before the questionnaire was released. The questionnaire was initially written in English and then translated to Arabic language using the committee approach as recommended by

Douglas and Craig (2007). This was done in order to decrease the cultural bias inherent in the native language. Then, the final questionnaire was sent by e-mail and the respondents were requested to return the completed questionnaires within 1 week. The questionnaire was sometime re-sent by e-mail many times till getting the answer. However, the authors were sometimes led to have telephone interviews with certain managers wishing to have more details on the objectives of our study (5 in all).

The data was collected from June 2024 till September 2024. A total number of 276 questionnaires were collected. Then, after the screening, 3 questionnaires were eliminated because of the missing data. At the end of the survey period, 273 questionnaires were obtained. Thus, the response rate was 76.47 %. **Table 1** displays the samples and characteristics of the respondents.

Table 1. Sample distribution (n = 273).

Details		**Frequency**	**Percent (%)**
Gender	Female	33	12.08
	Male	240	87.92
Activities	Manufacture of computer, electronic and optical products	80	29.30
	Manufacture of electrical equipment	193	70.70
Region	Qassim	12	4.40
	Riyadh	171	62.63
	Eastern region	90	32.97
Job title	CEO	13	4.76
	Human Resources manager	6	2.20
	Marketing manager	20	7.32
	Environmental protection manager	45	16.50
	Production manager	138	50.54
	R&D manager	48	17.59
	Other	3	1.09
Sample size (n)		273	100

Green market orientation measures were reformed from Narver and Slater (1990) with some items adopted from Deshpandé and Farley (2004). The scale is based on 18 items including 3 different dimensions and it was designed using Likert scale of five points. Then, a (PCA) with rotation VARIMAX was achieved with SPSS 26 to obtain the factor structure. The **Table 2** show the obtained results.

Previous studies indicated that green sustainable innovation can be measured by Chen et al. (2006) scale and Soewarno et al. (2019) scale. This construct included two dimensions. Results are shown in **Table 3**.

Table 2. Measurement scale of green market orientation.

Construct	Dimension	Items	Factor loading	Cronbach's α
GMO	Green customer orientation	GCO1. serving environmentally responsible customers	0.701	0.801
		GCO2. offering best green product for the customers	0.754	
		GCO3. Creating customer value	0.720	
		GCO4. Understanding customer needs	0.783	
		GCO5. the customer satisfaction	0.737	
		GCO6. The customer satisfaction measure by the company,	0.881	
		GCO7. Customer after-sales service	0.770	
		GCO8. Customers use of information provided by my company.	0.893	
	Green interfunction orientation	GIO1. lnterfunctional customer calls	0.777	0.823
		GIO2. Regular updates on client satisfaction statistics.	0.847	
		GIO3. Strategy's functional integration.	0.718	
		GIO4. Contribution to customer value	0.879	
		GIO5. Resources sharing with other business units.	0.850	
	Green competitor orientation	GPO1. Investment in environmentally friendly compared to competitors.	0.863	0.890
		GPO2. Sharing competitor information	0.909	
		GPO3. Quick reaction to competitors' actions	0.871	
		GPO4. Strategies of competitors debates	0.870	
		GPO5. Customer-oriented knowledge as competitive advantage.	0.905	

Table 3. Measurement scale of sustainable innovation.

Construct	Dimension	Items	Factor loading	Cronbach's α
Green sustainable innovation	Green product innovation	GPI 1. Company use of raw materials friendly to the environment.	0.827	0.734
		GPI 2. Energy-efficient raw materials using	0.831	
		GPI 3. Easily recyclable, reusable, and decomposable products.	0.720	
	green process innovation	GSI 1. Optimizing the use of raw materials in the production process.	0.888	0.820
		GSI 2. Reducing the emission of dangerous elements\or waste	0.853	
		GSI 3. Recycling emissions and waste.	0.848	
		GSI 4. Decreasing the use of water, electricity, or oil.	0.790	
		GSI 5. Innovations use to lower the amount of raw materials used during the production process.	0.750	

In the literature review, some authors measured the competitive advantage using single dimensional scale (Barney 1991; Coyne 1986; Porter and van der Linde 1995), and others consider it as multidimensional construct (Jie et al., 2013; Newbert, 2008; Sukati et al., 2011) composed of six dimensions namely price, delivery, quality, dependability, time to market and product innovation. We opted for the first single dimensional scale as it is focused more on the product innovation dimension. The **Table 4** displays every item that was used.

Table 4. Competitive advantage scale.

Construct	Items	Factor loading	Cronbach's α
Competitive advantage	COA 1. The products quality of the company are of a higher quality than those of the competitors.	0.916	0.899
	COA 2. R&D is better than the competitors	0.905	
	COA 3. The managerial capabilities are better than competitors	0.851	
	COA 4. The profit gained is better than competitors	0.849	
	COA 5. The corporate image is superior to that of the competitors	0.875	
	COA 6. Competitors are unable to replace the competitive advantage	0.873	

4. Results and discussion

4.1. Validating measures

To assess the structural model and the hypotheses, structural equation modeling (SEM) was carried out using Amos 26.0. The convergent validity was verified. After that, we applied the Fornell and Larcker (1981) criterion to verify the discriminant validity as shown in **Table 5.**

Table 5. Discriminant validity.

Constructs	GCO	GIO	GPO	GPI	GSI	COA
GCO	0.777					
GIO	0.333	0.793				
GPO	0.471	0.521	0.877			
GPI	0.661	0.658	0.679	0.800		
GSI	0.375	0.537	0.499	0.643	0.801	
COA	0.460	0.440	0.638	0.520	0.238	0.823

Then, our measurement model has been checked for nomological validity which is verified in this research in terms of construct items. As widely known, the nomological validity refers to establishing logical relation between a particular model construct and items.

4.2. Adjustment of the global model

In order to assess how well the measurement model fits the data based on the different indices generated by Amos output, Bentler (1990) recommended to check the three following fit indices: adjustment, incremental and parsimony indices. We gathered in **Table 6** the most important indices with the recommended cut-off values.

Table 6. Goodness of the fit indices.

Fit index	GFI	AGFI	RMSEA	CFI	TLI	IFI	CMIN/DF
Value	0.977	0.969	0.070	0.937	0.928	0.939	2.450
Acceptable value	≥ 0.9	≥ 0.8	≤ 0.05	≥ 0.9	≥ 0.9	≥ 0.9	< 3

The obtained values prove how significantly the absolute, incremental, and parsimony indices verify the acceptable level except the RMSEA who exceed a little

bit the acceptable value. This can be explained by the complexity of the model. But overall, our model fits well the data.

That said, our research model is also validated as shown in **Figure 2**.

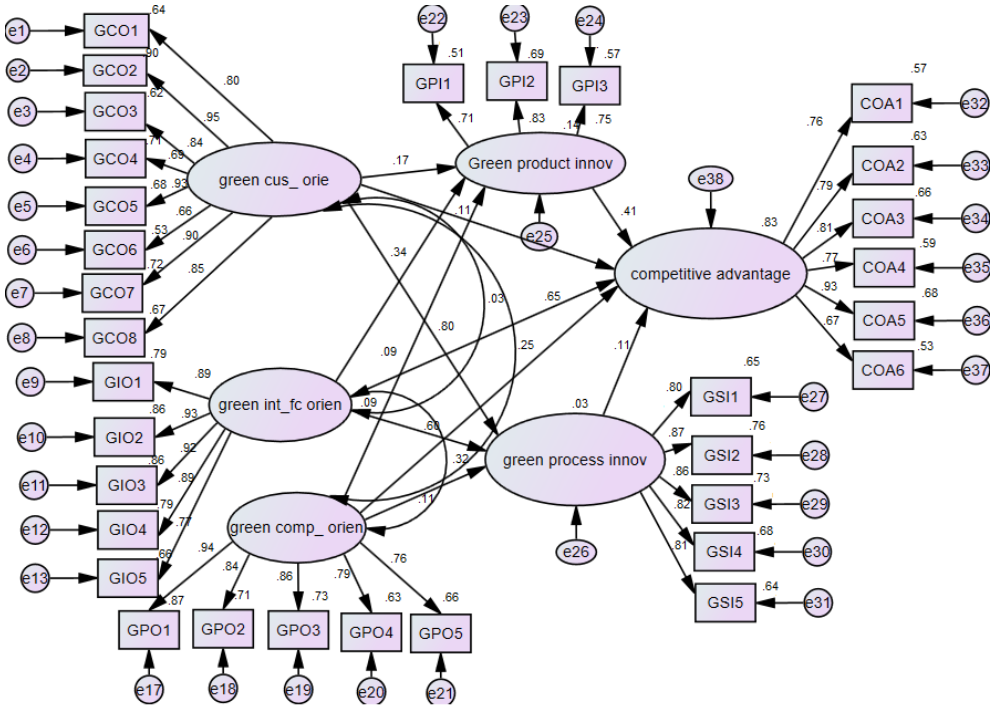

Figure 2. Measurement model.

Source: Amos 26 processing data.

4.3. Checking hypotheses of direct effects

The direct effect stipulated in the hypotheses will be considered as significant at the threshold of 5% following the student test (1.96) (). The data presented in **Table 7** point out that all the hypotheses were confirmed.

Table 7. Testing direct effects with structural equation model.

Parameter	Estimate	*t*-values	*p*-values	Empirical remarks
Green customer orientation → green product innovation	0.17	2.936	0.003	H1.a supported
Green customer orientation → green process innovation	0.80	4.950	***	
Green interfunctional orientation → green product innovation	0.34	3.381	***	H1.b supported
Green interfunctional orientation → green process innovation	0.60	3.910	0.001	
Green competitor orientation → green product innovation	0.90	5.112	***	H1.c supported
Green competitor orientation → green process innovation	0.11	2.901	0.004	
Green product innovation → competitive advantage	0.41	3.420	***	H2.a supported
Green process innovation → competitive advantage	0.11	2.901	0.004	H2.b supported
Green customer orientation → competitive advantage	0.11	2.901	0.004	
Green interfunctional orientation → competitive advantage	0.65	3.960	***	H3 supported
Green competitor orientation → competitive advantage	0.25	2.998	0.002	

Note: *** (significant at $p < 0.05$).

The findings demonstrated a strong direct and positive connection between green product innovation and green customer orientation ($t = 2.936$, $p = 0.003$). Additionally, a strong and favorable correlation was discovered between green process innovation and green consumer orientation ($t = 4.950$, $p = 0.000$). That said, this result supported the hypothesis H1. a. Likewise, green interfunctional orientation has a direct and positive effect on green product innovation ($t = 3.381$, $p = 0.000$) and also on green process innovation ($t = 3.910$, $p = 0.001$). As expected, H1. b was supported. Similarly, a significant structural link was found between green competitor orientation and green product innovation ($t = 5.112$, $p = 0.000$) and also between green process innovation ($t = 2.901$, $p = 0.004$). So that, the hypothesis H1.c was supported. Based on these results, we confirm that green market orientation significantly and favorably influences green sustainable innovation (H1. a, b and c confirmed).

As hypothesized, green sustainable innovation has a positive influence on competitive advantage. Thus, H2a ($t = 3.420$, $p = 0.000$) and H2b ($t = 2.901$, $p = 0.004$) were confirmed. Examining the impact of green market orientation on competitive advantage, the results shown in **Table 8** indicated that the effect is positive (H3 confirmed). That said, it appears the importance of testing the intermediating effect of the green sustainable innovation on the relation among competitive advantage and market orientation.

4.4. Checking the indirect effects

To confirm the green sustainable innovation's mediating role, we looked at the indirect effects. As the green sustainable innovation is measured by two variables, so our model contained two mediators. So it was very difficult to analyze directly the Amos output. Hence, we divided our model in different parts representing the different indirect effects between variables. Each indirect effect represented the part from independent variable to the mediator variable multiplied by the part from the mediator variable to the dependent variable. For example, part A represent the effect of green customer orientation and green product innovation, part B for the effect of green product innovation and competitive advantage. In sum, we identified 12 parts. Then, we proceeded to syntax check for errors on Amos, and then we calculated the estimates (see **Table 8** below).

Table 8. Test of indirect effects.

Indirect effects	Estimate	Lower	Upper	*P*	Empirical remarks
Ind1	0.037	0.006	0.091	0.020	H4ai supported
Ind2	0.009	0.002	0.024	0.013	H4bi supported
Ind3	0.056	0.026	0.101	0.001	H4aii supported
Ind4	0.008	0.001	0.023	0.012	H4bii supported
Ind5	0.039	0.008	0.093	0.023	H4aiii supported
Ind6	0.050	0.020	0.095	0.000	H4biii supported

Based on these results, we noticed that the mediation is complete as all the indirect effects tests were significant. Thus, we deduce that the link between green

market orientation and competitive advantage is mediated by green sustainable innovation. Therefore, hypothesis H4 is validated.

5. Discussion

This research confirms the whole hypotheses suggested and exposes the results as expected. The first hypothesis result show that GMO significantly and positively influences green sustainable innovation. Our results confirmed the previous findings of some scholars such as Borazon et al. (2022), Lin et al. (2014) and Wang (2020). However, our findings call into question the result put forward by some authors such as Li et al. (2021) who demonstrated the absence of any relation between green innovation and GMO due to the fact that they didn't consider the two form of green innovation. In fact, we confirmed that there is a positive and significant link between green customer orientation and green product innovation and green process innovation in Saudi context.

Also, green interfunctional orientation has a positive effect on both green product and green process innovation. So that, this result confirmed that market-oriented companies attempt to increase employees' green self-efficacy so they can develop green products innovation. Our results are consistent with what McGee and Peterson (2019) have stated. Furthermore, we confirmed that green competitor orientation has a positive effect on green product and green process innovation. These results underlined the fact that customers' preference for product eco-friendly will guide companies to push the demand on new green product as suggested by Kesidou and Demirel (2012). So as to appropriately describe the goals of companies to sustain green product innovation, it seems that market orientation is essential in presenting the green needs and wants of the customers in Saudi context. So that, our results supported those advanced by some scholars like Kneipp et al. (2019) whom stipulated that green sustainable innovation need to increase the value of services and products in order to decrease negative effects on environment that came from the industrial processes.

However, our results are opposed to those advanced by Du and Wang (2022) and Qiu et al. (2020) whom indicated that GMO have a more important influence on green product innovation compared to green process innovation. In sum, our result confirmed that market orientation strategies of the companies prioritize the production of innovative green products while considering the needs and desires of their customers as well as industry duties.

Then, we found a positive impact of green product and process innovation on competitive advantage. Referring to literature review, this result supported those of many scholars (Borsatto and Amui, 2019; Chen et al., 2006; Chiou et al., 2011; Klassen and Whybark, 1999; Porter and Van der Linde, 1995; Rao, 2002; Sellitto et al., 2020; Tu and Wu, 2020; Yin et al., 2020)

Over all, our findings reinforced the fact that the integration of green technology and innovation enhances a company's capacity to implement novel technologies that safeguard natural resources and preserve the environment. In addition, Saudi firms can be effective when they achieve corporate competitiveness by conserving the environment as stipulated by Arseculeratne and Yazdanifard (2014). This result is

opposed to the outcomes of Singjai et al. (2018). These authors found a weak link between green innovation and competitive advantage.

Then, we confirmed hypothesis 3 addressing how green market orientation significantly affects competitive advantage. As expected, our results are consistent with the results of Leonidou et al. (2015) and Papadas et al. (2019) but are opposed to the findings of some other researchers such as Digdowiseiso and Lestari (2021) who claimed that green market orientation doesn't affect the competitive advantage of the company. This divergence in results may be explained by the difference of the context. Based on the literature, it appears that the firms with a green market orientation will gain in competitive advantage by decreasing their negative impact on environment and enter into competition with other green competitors as the current consumers are more and more conscious and have a tendency to buy ecologically friendly products (Tjahjadi et al. 2020). The last hypothesis tested the effect of green sustainable innovation as mediator of the relationship between green market orientation and competitive advantage. In fact, this result will help the decision maker in Saudi companies to understand the real impact of green sustainable innovation and green market orientation and how it influences the competitive advantage. So, in order to meet the demands of environmentally conscious consumers and to be more competitive with other Saudi companies, it is critical to encourage green process and green product innovation. These results offered a better understanding for the Saudi managers about the mechanism by which they can participate in the sustainable development as stipulated by the kingdom's vision 2030.

6. Conclusion and implications

The globe is currently dealing with severe social, economic, and environmental problems. Many countries were conscious about the importance of change because of the excessive use of the planet's resources. Saudi Arabia is one of these countries that focuses on sustainable development by introducing the optimistic kingdom's vision 2030. Several studies indicate that the way to go to the sustainable development is through green sustainable innovation. In this research, the association between green sustainable innovation, green market orientation and competitive advantage was tested in Saudi context. Using a sample of 273 manufacturers of electronic, computer, optical products and electrical equipment in Riyadh, Qassim and Eastern region, this research demonstrated that GMO has a favorable impact on competitive advantage and green sustainable innovation.

In order to meet industry obligations as well as client preferences and the transition to greener market, companies that employ market orientation strategies want to develop innovative green products. So, in order to enhance competitive advantage in an environmentally conscious period, Saudi managers must comprehend the critical role that green innovation plays as a tool for implementing environmentally friendly business practices.

This study offers theoretical, methodological, and managerial contributions. First, it enhances the understanding of green market orientation (GMO) within environmental marketing literature. Traditionally, competitiveness in the market was primarily driven by quality and price. However, in the current business environment,

addressing environmental concerns has become essential for organizational sustainability. GMO, as described by Li et al. (2018), acts as a strategic resource that allows businesses to build unique capabilities to meet and exceed customer expectations while managing the environmental strategies of competitors. GMO extends beyond the mere adoption of eco-friendly practices, requiring the strategic integration of these practices into a company's operations and alignment with long-term objectives. This strategic approach positions businesses to better anticipate customer demands, respond to competitive pressures, and achieve sustainable growth.

Additionally, this research highlights the relationship between GMO and green innovation. Green innovation, which involves creating and implementing environmentally friendly technologies, processes, and products, is identified as a key driver of competitive advantage. Together, GMO and green innovation form a comprehensive framework that enables businesses to achieve sustainable competitiveness, particularly in today's environmentally conscious markets.

From a methodological perspective, this research addresses a significant gap by focusing on green innovation within the Saudi Arabian context, a region that has been underexplored compared to Western and Asian markets (e.g., Chiou et al., 2011; Lin et al., 2014; Saputra et al., 2020; Yang and Lin, 2020). Saudi Arabia, currently undergoing an economic transformation under Vision 2030, presents unique challenges and opportunities for green innovation. The country's industrial sector, which has traditionally relied on resource-intensive operations, is now transitioning toward sustainability as part of its national development agenda.

To thoroughly examine the relationships among variables, this study utilizes structural equation modeling (SEM), a sophisticated statistical tool capable of analyzing multiple interconnected relationships simultaneously. Unlike conventional methods, SEM accommodates latent variables—abstract concepts such as GMO and green innovation inferred through observable indicators—and reveals the intricate pathways linking these variables to outcomes such as competitive advantage.

The application of SEM provides crucial insights. By investigating the causal relationships between GMO, green innovation, and competitive advantage, the research demonstrates how businesses can effectively adopt green practices. It shows that GMO is a foundational driver of innovation, enabling organizations to develop environmentally friendly products and processes that appeal to eco-conscious consumers. These innovations subsequently enhance competitiveness by differentiating the organization's offerings in the marketplace. Furthermore, SEM confirms the mediating role of green innovation in the connection between GMO and competitive advantage, underscoring the importance of innovation as a link between strategic orientation and tangible business outcomes.

By quantifying these relationships, this study presents a robust framework that managers and policymakers can leverage to develop and implement sustainable business strategies.

This research carries profound managerial implications, especially for Saudi managers operating in sectors such as electronics, computer manufacturing, optical products, and electrical equipment. By embracing green innovation strategies, managers can not only enhance their company's environmental performance but also elevate its reputation in a competitive marketplace. A robust green image positions

companies as sustainability leaders, appealing to environmentally conscious customers and stakeholders. This enhanced reputation serves as a strategic advantage, enabling companies to access new markets and customer segments that prioritize sustainable products.

The focus on green innovation aligns with insights from Pheng Low et al. (2014), who emphasize the value of incorporating eco-friendly resources and technologies into business operations. By adopting these practices, Saudi companies can demonstrate their commitment to environmental responsibility, solidifying their brand identity while aligning with global sustainability trends. This proactive approach enhances their competitiveness in international markets, where partnerships and collaborations increasingly hinge on demonstrable sustainability credentials.

Green market orientation and sustainable innovation also offer opportunities to significantly improve market positioning. By embedding environmentally friendly practices into their strategies, Saudi managers can cultivate a positive green image for their products and organizations. This improved perception directly influences consumer behavior, as environmentally conscious customers tend to favor brands that reflect their values. Chen (2010) highlighted a strong green image can lead to an increased market share by giving companies a competitive edge over less sustainable rivals.

Moreover, green market orientation facilitates better product positioning by ensuring that eco-friendly products achieve "top-of-mind recall" among consumers. This means that when customers think of sustainable options, these products are their first choice. Such preferential recall not only boosts short-term sales but also fosters long-term customer loyalty, ensuring consistent profitability.

In addition to reputational and market gains, green innovation yields tangible financial benefits. Companies adopting sustainable practices often experience reduced production costs through improved resource efficiency and minimized waste. For example, energy-saving technologies and optimized material usage can result in significant cost reductions. These savings can be reinvested into further innovation, creating a cycle of continuous improvement and competitiveness. Additionally, companies with a strong green market orientation can justify premium pricing for their products, as consumers are often willing to pay more for offerings that align with their environmental values. This pricing advantage, coupled with operational cost savings, translates into higher profit margins, making green innovation a compelling business strategy.

Businesses that integrate green market orientation into their core strategies gain a distinct competitive advantage. In an era where sustainability is a critical consideration, these companies are perceived as forward-thinking and socially responsible. Such positioning attracts environmentally conscious consumers and ensures compliance with evolving regulatory requirements that increasingly favor sustainability.

For Saudi managers, the alignment of green innovation with Vision 2030 provides an additional layer of incentive. By incorporating sustainability into their business models, companies can contribute to the Kingdom's broader development objectives while achieving their own organizational goals. This alignment not only enhances their credibility with policymakers and stakeholders but also positions them

for future growth and success. Integrating green practices into the corporate vision and operations allows Saudi businesses to balance profitability with sustainability, paving the way for long-term resilience in a competitive and environmentally aware global market.

This research provides significant insights aimed at encouraging Saudi managers to recognize the tangible benefits of integrating green sustainable innovation into their business operations. Many organizations in the region often include sustainability in their vision or mission statements without embedding these principles into their functional activities. This "formal but not functional" approach renders sustainability initiatives ineffective, reducing them to symbolic gestures rather than actionable, impactful strategies.

The findings emphasize the need for Saudi managers to transition beyond surface-level commitments and instead adopt green sustainable innovation as a foundational component of their operational framework. This entails embedding environmentally conscious practices throughout the organization, including product design, manufacturing processes, marketing strategies, and supply chain management. Such comprehensive integration ensures that sustainability becomes both a guiding philosophy and a measurable element of the company's value proposition.

The study also highlights the importance of aligning corporate practices with Vision 2030, Saudi Arabia's strategic roadmap for economic diversification and sustainable development. Vision 2030 underscores environmental responsibility, resource efficiency, and innovation as key pillars of national progress. By adopting green sustainable innovation, Saudi businesses not only contribute to these national objectives but also position themselves as leaders in the Kingdom's transformative journey.

For Saudi managers, alignment with Vision 2030 offers more than compliance with governmental goals—it represents an opportunity to establish their organizations as proactive contributors to sustainable development. Companies that engage meaningfully in these efforts are better positioned to gain the trust of stakeholders, attract environmentally conscious consumers, and benefit from government initiatives and incentives designed to support green practices.

While the study offers actionable recommendations, it is also essential to acknowledge its limitations. Factors such as a relatively small sample size, a focus on specific industries, or reliance on methodological approaches like structural equation modeling (SEM) may constrain the generalizability of the findings. Future research could address these gaps by incorporating a broader range of variables, exploring diverse industries, or expanding into other regions to develop a more comprehensive understanding of green sustainable innovation.

Additionally, the study does not fully account for cultural and organizational challenges that may hinder the implementation of green initiatives. Resistance to change, lack of technical expertise, or limited resources can act as significant barriers to the adoption of sustainable practices. Acknowledging these obstacles is critical for devising strategies that enable managers to overcome them and achieve meaningful progress in embedding sustainability into their business models.

Ultimately, this research serves as both a practical guide and a call to action for Saudi managers. By illustrating the strategic, financial, and reputational advantages of

green sustainable innovation, it encourages managers to move beyond symbolic commitments and adopt concrete, impactful measures toward sustainability. Companies that embrace this transformation stand to gain a competitive advantage in the increasingly eco-conscious global market while contributing to the Kingdom's ambitious Vision 2030.

In conclusion, while the research provides valuable insights, it also underscores the need for continued exploration and refinement of strategies related to green sustainable innovation. This ensures that businesses remain adaptive, forward-thinking, and genuinely committed to sustainability, enabling them to thrive in a future shaped by environmental and economic challenges.

Firstly, the small sample size used in this study limits the ability to generalize the findings. This limitation is particularly significant when using clustering techniques, as small samples may result in unstable clusters or fail to represent the broader diversity of patterns and behaviors among tourism SMEs. Consequently, these results should be approached cautiously, as they may not fully capture the variability across the population. Future research should aim to use larger sample sizes to improve the reliability and generalizability of the findings and ensure more stable outcomes when applying clustering methods.

Secondly, relying on self-reported data collected through questionnaires introduces the possibility of human error and response bias. Participants might have misunderstood some questions or given responses that they perceived as more socially acceptable, potentially distorting the data and affecting the study's conclusions. To address this, future research should consider methodological triangulation by incorporating additional data sources, such as secondary data, direct observations, or in-depth interviews. This approach could help reduce biases and improve the accuracy and credibility of the results by validating them through multiple perspectives.

Thirdly, the study evaluates competitive advantage using a single-dimensional scale, which might oversimplify this multifaceted construct. Competitive advantage includes diverse dimensions such as cost leadership, differentiation, and innovation, and focusing on a single aspect may neglect other critical components. This limitation might hinder the study's ability to thoroughly understand the intricate relationships involving competitive advantage and other variables. Future studies should adopt a multidimensional approach to measuring competitive advantage, enabling a more comprehensive analysis of its complexities and its role in the interplay between green innovation and sustainability.

To overcome these limitations, future research could address these challenges in several ways. Increasing the sample size and employing advanced sampling techniques, such as stratified or purposive sampling, could enhance the generalizability and allow for more detailed subgroup analyses. Additionally, integrating secondary data or conducting in-depth interviews would provide richer and more reliable data, minimizing response biases and ensuring the findings are robust through triangulation. Furthermore, refining the measurement of competitive advantage to include multiple dimensions would offer a deeper understanding of its interaction with green innovation and marketing performance.

Moreover, while previous studies have extensively explored the impact of green innovation on performance, the combined relationships between green innovation,

competitive advantage, and marketing performance are still under-researched. Future investigations should delve into these interconnected relationships to better understand how green innovation can drive sustainable growth in tourism SMEs. Additionally, examining green self-efficacy as a mediator between green market orientation and green innovation presents a promising research direction. This could provide valuable insights into how beliefs in the ability to implement green practices influence broader outcomes, such as achieving a sustainable competitive advantage.

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