

Article

The Antecedents of Green Strategic Orientations on Competitiveness: An Empirical Structural Model

Javier Eduardo Vega Martinez ¹, Maria del Carmen Martinez Serna ^{2,*}
and Maria del Carmen Bautista Sanchez ²

¹ Centro de Ciencias Empresariales, Universidad Autonoma de Aguascalientes, Aguascalientes 20340, Mexico; javier.vega@edu.uaa.mx

² Centro de Ciencias Economicas Administrativas, Universidad Autonoma de Aguascalientes, Aguascalientes 20100, Mexico; carmen.bautista@edu.uaa.mx

* Correspondence: carmen.martinezs@edu.uaa.mx

Abstract

This study examines the influence of green market orientation (GMO) and green entrepreneurial orientation (GEO) on business competitiveness in increasingly demanding environmental contexts. Drawing on the literature on strategic management and sustainability, this research analyzes how environmentally oriented market and entrepreneurial capabilities contribute to strengthening firms' competitive positioning. Using a quantitative approach, data were collected from 200 companies in the agri-food and manufacturing sectors, and the data were analyzed through Partial Least Squares Structural Equation Modeling (PLS-SEM). The results confirm that both GMO ($\beta = 0.534$; $p < 0.001$) and GEO ($\beta = 0.395$; $p < 0.001$) have a significant influence on competitiveness, with GMO showing a stronger impact. These findings suggest that firms integrating environmental market demands and fostering innovation, proactiveness, and risk-taking with an ecological focus achieve enhanced competitive performance. This study concludes that green-oriented strategic capabilities constitute key drivers of sustainable competitive advantages and represent a relevant pathway for organizational strengthening in dynamic and environmentally regulated markets.

Keywords: green strategic orientation; competitiveness; green market orientation; green entrepreneurial orientation

1. Introduction

Environmental sustainability has become a central strategic concern for firms operating in increasingly complex and competitive markets. Growing pressures from governments, consumers, investors, and supply-chain stakeholders have compelled organizations to incorporate environmental considerations into their strategic decision-making processes. However, despite the growing relevance of sustainability within business strategy, its implications for competitiveness remain contested. While the Pollution Haven Hypothesis argues that environmental requirements may increase operational costs and undermine firms' competitive positions, the Porter Hypothesis suggests that environmental pressures can stimulate innovation, efficiency improvements, and long-term competitive advantages [1]. Recent empirical evidence indicates that this debate remains unresolved. Dou and Lee [2] report that environmental regulation may enhance productivity under certain contextual conditions, whereas Fabrizi et al. [3] emphasize that the effects of environmental initiatives on innovation and competitiveness continue to vary across industries and



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institutional settings. Consequently, understanding how firms transform environmental pressures into competitive outcomes remains an important challenge for sustainability and strategic management research.

To explain these heterogeneous outcomes, scholars have increasingly shifted attention from external environmental pressures toward firms' internal capabilities. The Natural Resource-Based View (NRBV) argues that environmental challenges may foster the development of distinctive organizational capabilities capable of generating competitive advantages while simultaneously addressing ecological concerns [4]. Rather than viewing sustainability as a constraint, the NRBV proposes that firms differ in their ability to transform environmental demands into innovation, market opportunities, and superior competitive outcomes.

Although competitiveness is frequently associated with competitive advantage and organizational performance, these concepts represent different theoretical domains. Competitive advantage refers to the strategic resources and capabilities that allow firms to outperform competitors, whereas performance represents the outcomes achieved from those strategic positions. Competitiveness, in contrast, reflects the broader condition of a firm's ability to compete effectively through the development of capabilities and the achievement of superior competitive conditions.

Following Buckley et al. [5], competitiveness is considered a multidimensional construct that encompasses different aspects of firms' competitive conditions rather than a single performance outcome. Therefore, dimensions such as perceptual competitive performance (competitive performance), cost efficiency (competitive process), and technological capability (competitive potential) are conceptualized in this study as reflective manifestations of competitiveness because they represent expressions of a firm's overall competitive condition.

To explain these heterogeneous outcomes, scholars have increasingly shifted attention from external environmental pressures toward firms' internal capabilities. The Natural Resource-Based View (NRBV) argues that environmental challenges may foster the development of distinctive organizational capabilities capable of generating competitive advantages while simultaneously addressing ecological concerns [4].

Therefore, identifying the environmental capabilities that enable organizations to achieve competitiveness under ecological pressures has become a research priority. Among these capabilities, GMO has attracted growing attention because it enables firms to integrate environmental concerns into market intelligence and strategic decision-making processes. According to Chen et al. [6], environmentally oriented market strategies play a critical role in enhancing green competitiveness by improving firms' ability to respond to stakeholder expectations and consumer demand and sustainability-related market opportunities.

In the same vein, GEO has emerged as another important capability through which firms address environmental challenges. GEO reflects an organization's propensity to proactively identify environmental opportunities, promote green innovation, and create both economic and ecological value. Jin and March Chorda [7] identify GEO as one of the fastest-growing domains within sustainability and entrepreneurship research, highlighting its relevance for sustainable development and environmental innovation. Nevertheless, these authors also argue that important aspects of GEO remain insufficiently understood, particularly regarding the mechanisms through which this orientation contributes to organizational outcomes. This observation suggests that further research is needed to clarify how environmentally oriented capabilities influence firms' competitiveness.

Despite the increasing relevance of GMO and GEO, important theoretical questions remain unanswered. Existing research has primarily linked these capabilities to outcomes such as innovation, environmental performance, sustainability, and resilience [6,7]. How-

ever, comparatively less attention has been devoted to understanding their contribution to competitiveness, despite the persistent debate regarding whether environmentally oriented strategies ultimately strengthen or weaken firms' competitive position [3].

The objective of this study is to examine the effects of GMO and GEO on competitiveness among firms operating in the manufacturing and agri-food sectors in a specific emerging country context. This study extends the Natural Resource-Based View (NRBV) by empirically operationalizing GMO and GEO as complementary intangible strategic resources. In doing so, it contributes to bridging the gap between theoretical propositions and empirical validation.

The remainder of this paper is organized as follows. Section 2 reviews the relevant literature and develops research hypotheses. Section 3 describes the methodology, including the sample, measurement instruments, and data analysis procedures. Section 4 presents the empirical results and discusses the findings. Section 5 provides further discussion, and finally, Section 6 sets out the conclusions, theoretical and managerial implications, limitations, and directions for future research.

2. Literature Review

It is essential to examine the conceptual elements that define green market orientation from a sustainable perspective, as well as its interaction with green entrepreneurial orientation. Based on this analysis, the aim is to establish the basis for explaining how the integration of both constructs contributes to the competitiveness of Mexican agri-food and manufacturing companies.

2.1. Green Market Orientation

GMO emerges as an extension of the traditional market orientation (MO) concept, which is defined as the organizational process of generating, disseminating, and responding to market intelligence [8]. In addition, MO has been conceptualized as an organizational culture composed of customer orientation, competitor orientation, and interfunctional coordination [9].

However, increasing environmental challenges have revealed the limitations of traditional MO, prompting the evolution toward approaches that integrate economic objectives with environmental and social concerns. In the sense, GMO has been defined as a strategic orientation that incorporates considerations of market intelligence processes, enabling firms to respond to environmentally conscious stakeholders [10–12].

From the theory of Natural Resource-Based Vision (NRBV) it is understood that organizations can develop ecological capacities that adequately and proactively address the challenges that arise in the environment to be competitive [13]. This is why the GMO becomes a resource that allows environmental challenges to become opportunities that provide differentiable values in the market.

Prior research has associated GMO with a variety of organizational outcomes, including green innovation, corporate reputation, knowledge management, and sustainable performance [10,14,15]. These studies highlight the broad influence of GMO on firm behavior and performance. However, rather than incorporating all these outcomes simultaneously, this study adopts a focused approach by considering competitiveness as the primary outcome variable.

Thus, GMO is conceptualized in this research as a strategic capability that integrates environmental considerations into market-oriented processes and activities to provide goods or services focusing on green consumers [16], enabling firms to enhance their responsiveness to sustainability-related demands and strengthen their competitive positioning.

An essential aspect of the theoretical and empirical consolidation of GMO is its measurement. The literature has offered different approaches in terms of the scales and dimensions that allow the construct to be operationalized. Along these lines, a three-dimensional model has been proposed that includes, in addition to customer and competitor orientation, green cross-functional coordination, understood as cross-functional collaboration between different areas of the organization to share, analyze, and leverage environmental information [17,18].

Likewise, some studies have resorted to adapting previous scales, incorporating items that capture the strategic commitment of senior management and the integration of green values into the organizational culture [19–21]. These proposals show that the measurement of GMO can vary between more parsimonious and more comprehensive approaches, depending on the level of theoretical complexity and the empirical context in which it is applied. In any case, according to the literature, GMO was synthesized using a 10-item scale based on a more parsimonious definition previous developed by Deshpande et al. [20] and adapted by Tjahjedi et al. [19] and Fatoki [21] and slightly modified to accommodate the issue of environmentally friendly market orientation.

In this way, the scales developed over recent years allow us not only to refine the conceptualization of GMO but also to more accurately assess its impact on critical variables such as green innovation, corporate reputation, knowledge management, and, ultimately, the sustainable competitiveness of organizations.

Collectively, these findings suggest that GMO contributes to competitiveness not through a single mechanism, but through a combination of organizational processes. By enhancing firms' ability to identify environmental market demands, develop green innovations, strengthen corporate reputation, and improve knowledge management practices, GMO creates valuable and difficult-to-imitate capabilities that support long-term competitive positioning. From the NRBV perspective, these capabilities represent strategic resources that allow firms to transform environmental challenges into sources of competitive advantage.

2.2. Green Entrepreneurial Orientation

The current business environment has become increasingly complex, while environmental and sustainability challenges have intensified. There is greater concern on the part of the business sector to increase corporate sustainability and generate a competitive advantage through the application of responsible environmental practices, motivated by ethical reasons and resilience in their operations [22–25].

For this reason, entrepreneurial orientation (EO) has been considered a key capability for companies for years due to the need to constantly differentiate themselves from the competition to gain an advantage and survive in a market that is constantly evolving due to globalization [26,27]. EO is commonly defined as a firm's strategic posture characterized by innovativeness, risk-taking, and proactiveness in pursuing new opportunities [28]. Some authors extend this conceptualization by incorporating additional dimensions such as competitive aggressiveness and autonomy [29,30].

However, traditional EO primarily emphasizes economic outcomes such as growth and profitability. In response to increasing environmental concerns, the concept has evolved toward green entrepreneurial orientation (GEO), which integrates environmental considerations into entrepreneurial decision-making. GEO reflects a firm's strategic inclination to identify, develop, and exploit opportunities that simultaneously generate economic value and address ecological challenges [31,32].

From a theoretical standpoint, GEO is grounded in the Resource-Based View (RBV), as it represents an intangible capability that allows firms to reconfigure resources to-

ward sustainable innovation, and is a strategic trend through which organizations seek to take opportunities that lead to better results with the creation of green products and services [33,34]. With this strategic orientation, it is possible to anticipate the demands that arise in the market and respond with decisions that environmentally satisfy consumers who are more aware of environmental damage, as well as adapt to the regulations that governments and suppliers establish.

In previous studies, GEO has been related to different variables, both moderating and transcendental, for example, environmental uncertainty in high-tech contexts or an overly volatile demand, demonstrating that GEO improves the flexibility and response of organizations. It has also been linked to studies incorporating the variable of supply chain management, in which GEO leads to more responsible adoption in green manufacturing, reverse logistics, and recycling practices. In addition, its influence on corporate social responsibility has also been studied, which allows one to amplify the positive effects on competitive advantages [35–39]. What allows us to understand the GEO is a strategic orientation that is integrated into firms in different domains of action.

Regarding its measurement, GEO has been addressed using various scales, which have been developed, validated, and used in previous research [39–44]. These instruments have a theoretical basis in different organizational environments, which is reflected in their validation of published results. While one approach builds on the original model of entrepreneurial orientation (EO), integrating its core pillars (innovation, proactivity, and risk taking) into the environmental context [35–38]. Operationally, five items are drawn from previous empirical works and explicitly formulated in ecological terms as the tendency toward high-risk green projects, green R&D, and technological leadership and green market initiatives. Such scales are conceptually anchored in the entrepreneurial orientation tradition while explicitly incorporating ecological considerations [30,45].

In the same order of ideas, GEO operates as a capability that allows the firms to proactively serve and exploit sustainability-related opportunities. With the integration of green practices such as the management of sustainable distribution channels, and strong relationships with all stakeholders, GEO facilitates and promotes adaptation in firms to achieve competitiveness.

2.3. Competitiveness

Competitiveness from a business perspective is the sustainability capacity of the enterprise, which includes the enterprise market share and economic results [43]. Also from this perspective, competitiveness is considered to be the firm's ability to compete with other companies and achieve a favorable position that allows it to perform better than those competitors [46].

Along the same lines, Buckley et al. [5]. study the construct of competitiveness and point out that, from the business perspective, it is a construction of several dimensions, among which it is possible to understand competitiveness as a process, as a potential vision and as a result; so this construction must be understood as a multidimensional phenomenon. In the bibliographic review of previous studies in which this perspective has been adopted, technological capabilities have been considered as part of the potential dimension, since they incorporate a reflection of the resources based on the company's knowledge and its capacity for innovation—competitive performance as a result dimension—since it incorporates performance results in relation to competitors and cost efficiency as the process dimension, which reflects the effective use of resources and operational improvements.

Although in the literature the terms of firm performance, competitive advantages and competitiveness are studied are used in some studies in a similar way, it is important to note that competitive advantage identifies the superior place that the company obtains in

relation to its competition after having developed strategies with added value [17,47], and when performance is pointed out, it should be visualized as a result that is obtained in the company [48]; which allows us to understand that when we talk about competitiveness we refer to a construct in which it is understood that a capacity is underpinned that allows the development and maintenance of both better results in performance and sophistication advantages for developing superior values for the market [49]. Therefore, it is important to consider that competitiveness in this study understands performance as a result and competitive advantages as manifestations of competitiveness and not the equivalence of the construct [50]. This is necessary to consider in order to avoid confusion with the theoretical clarity of the constructs that will be pointed out in this empirical research.

According to the literature, competitiveness has been approached from the theoretical perspective of resources and capabilities, in which it is considered that the company combines these elements to generate unique resources that are difficult to imitate, creating competitive advantages for the firm; in this sense it is considered that it has a combination of elements that generates unique and unrepeatable resources, creating distinctive and valuable competitive advantages [51,52]. Some of the resources that are distinguished by the important role they play in achieving competitiveness are technology, knowledge, and the firm's capacity for efficiency in management [53]. Similarly, cost efficiency and technological capabilities are factors that allow the company the possibility of optimizing operations and responding to market conditions [5].

Previous studies have considered competitiveness as a multidimensional construct, pointing out that it is a capacity that strengthens innovation, technological capacity and flexibility in strategic decision-making [54–57].

In our review of the empirical literature, studies that have measured competitiveness as a reflective–reflective construct determining financial results, technological capabilities and cost efficiency are found. The same considerations have been taken for the study of the concept of competitiveness

2.4. Green Market Orientation and Competitiveness

Green market orientation (GMO) plays a critical role in enhancing firm competitiveness by enabling organizations to integrate environmental considerations into their market strategies. From the perspective of the Natural Resource-Based View (NRBV), GMO can be understood as an intangible capability that allows firms to develop valuable, rare, and difficult-to-imitate resources, which contribute to sustained competitive advantage [13].

The influence of GMO on competitiveness can be explained through its ability to improve firms' responsiveness to environmental and market changes, facilitate the identification of emerging green opportunities, and support the development of differentiated value propositions. These capabilities enable firms to compete more effectively by aligning their products and processes with evolving sustainability demands.

Empirical evidence supports the positive relationship between GMO and competitiveness. Previous studies have found that firms with strong GMO practices achieve higher levels of competitive advantage and performance, particularly through the development of green capabilities, environmental responsiveness, and sustainable value creation [52,56,58]. While prior research has identified mechanisms such as innovation and reputation as channels through which GMO exerts its influence [14,15], this study focuses on its overall direct effect to maintain a parsimonious and theoretically consistent model.

Among the findings is the ability of GMO to consolidate competitive advantages in turbulent environments, as it allows for the development of green knowledge management and strengthens more efficient organizational learning [59].

Increased customer demand for green products has led to the production of more environmentally friendly items, as it achieves greater environmental and social impact, creating value and benefits that influence more competitive companies [60].

Similarly, research based on 322 hotels identified in prior studies emphasizes the relevance of a GMO that seeks to focus on customer needs, which is relevant in business competitiveness processes [61]. Evidence of direct positive results from green strategies in sustainable and financial performance can also be found in the automotive sector [62]. Meanwhile, a study of 393 Turkish SMEs shows the positive effect on sustainable corporate performance [58].

From a strategic capability perspective, GMO influences competitiveness because it enables firms to acquire and exploit environmental market knowledge. Firms with strong green market orientation are better able to identify changes in customer preferences, regulatory expectations, and environmental trends. This knowledge allows organizations to adapt their products, processes, and value propositions, generating differentiation capabilities and improving their competitive position [50,63].

Therefore, the influence of GMO on competitiveness is explained not only by a firm's ability to respond to green market demands but also by its capacity to transform environmental information into strategic actions. Through this mechanism, GMO contributes to the development of competitive capabilities associated with technological adaptation, efficiency improvement, and market positioning.

Based on the above arguments, the following hypothesis is formulated:

H1. *GMO has a positive and significant influence on competitiveness.*

2.5. Green Entrepreneurial Orientation and Competitiveness

Green entrepreneurial orientation (GEO) plays a critical role in enhancing firm competitiveness by enabling organizations to proactively identify and exploit environmentally sustainable opportunities. As an extension of entrepreneurial orientation, GEO reflects a strategic capability that integrates innovation, proactiveness, and risk-taking within an environmental context, allowing firms to respond effectively to dynamic market and ecological demands.

From the perspective of the Resource-Based View (RBV), GEO constitutes an intangible capability that supports the development of valuable, rare, and difficult-to-imitate resources. These capabilities enable firms to generate differentiated value propositions through green products, services, and processes, thereby strengthening their competitive positioning [32,64,65].

The relationship between GEO and competitiveness can be explained through several underlying mechanisms. First, GEO promotes sustainable innovation by encouraging firms to invest in environmentally friendly technologies and develop eco-innovative solutions, which enhance both market differentiation and operational efficiency [66,67]. Second, GEO improves organizational flexibility and responsiveness, particularly in contexts characterized by technological turbulence and environmental uncertainty, enabling firms to adapt more effectively to changing conditions [35,68]. Third, GEO facilitates the integration of environmental criteria across the value chain, including responsible sourcing, green manufacturing, and reverse logistics, which contribute to improved performance and long-term strategic advantages [36,37].

Additionally, GEO strengthens firms' legitimacy and stakeholder relationships by aligning business practices with growing societal and environmental expectations. This alignment enhances trust, reputation, and institutional support, which are essential components of competitiveness, particularly for small- and medium-sized enterprises operating under resource constraints [38,39].

Other studies highlight the element of innovation within GEO as a positive influence on competitive advantage, since entrepreneurial thinking within the firm has a significant impact on innovative ideas and on the drive to develop eco-innovation, leading to a positive effect on strategic competitiveness and sustainable competitiveness [66,67].

Rather than representing isolated effects, these mechanisms collectively explain how GEO influences firm competitiveness by shaping strategic behavior and enabling firms to create sustainable value. In this sense, GEO should be understood as a higher-order capability that drives competitive advantage in environmentally sensitive markets.

GEO contributes to competitiveness through firms' proactive ability to identify and exploit sustainability-related opportunities. Unlike reactive environmental approaches that mainly focus on compliance, GEO encourages firms to search for new solutions, experiment with innovative alternatives, and redesign existing processes. These behaviors strengthen firms' ability to develop technological capabilities, improve resource utilization, and create differentiated offerings [69,70].

Consequently, GEO represents a strategic capability that allows firms to transform environmental challenges into competitive opportunities. Through innovation and strategic renewal, firms with higher levels of GEO are better positioned to maintain and strengthen their competitive conditions.

Based on the above arguments, the following hypothesis is proposed:

H2. *Green entrepreneurial orientation has a positive and significant influence on competitiveness.*

In addition, it is important to address the scope and structure of the proposed model considering the literature. Previous studies have frequently examined the effects of green market orientation and green entrepreneurial orientation through mediating or moderating variables such as innovation, corporate social responsibility, or supply chain practices. This approach allows for a clearer interpretation of the strategic relevance of green orientations, highlighting their capacity to directly influence firm competitiveness without the need for additional intervening variables.

3. Materials and Methods

This study has a quantitative approach and uses a cross-sectional sample measurement. This study focused on measuring the impact of GEO and GMO levels on the competitiveness of agri-food and manufacturing companies in Aguascalientes, Ags. Mexico. The measurement instrument was developed after a process of identifying scales previously used and validated in similar studies. The collected data were analyzed using Structural Equation Modeling (SEM) with SMART-PLS 4, version 4.1.1.5 software.

3.1. Measurement of the Variables

As mentioned above, in the process of developing the measurement instrument, validated scales used in similar fields of study were sought, and these scales were used to analyze the constructs of GMO, GEO, and competitiveness. To assess the construct of GEO, a scale derived from the study by Habib et al. [71] was used, which operationalizes the three classic dimensions, innovation, proactivity, and risk-taking. However, these were reinterpreted from an environmental perspective. The factor analysis confirms that the five items load on a single factor, demonstrating the unidimensional nature of the construct [44].

The construct GMO is defined by Tjahjedi et al. [19] as the perceived strategies and actions to offer goods or services targeted to eco-friendly consumers. To measure the construct, a unidimensional scale consisting of 10 items was used, assessing the degree to which a company focuses its objectives, strategies, and processes on the needs of environmentally friendly consumers [19], considering aspects related to the strategic approach to

eco-friendly customers, the systematic generation and measurement of satisfaction information, investment in green products and green services, and the internal dissemination of such information within the organization [21]. This scale is derived from the classic market orientation measurements [20] adapted by the authors to the environmental context and has shown solid reliability properties. It is measured on a five-point Likert scale.

Competitiveness was measured using an adapted scale originally developed from the conceptual framework proposed by Buckley et al. [5] and later operationalized by Maldonado Guzmán [72] and Maldonado-Guzmán et al. [73]. Consistent with Buckley's conceptualization, competitiveness was assessed as a multidimensional construct composed of competitive performance, cost efficiency, and technological capability.

The competitive performance dimension was measured through comparative perceptual indicators related to the firm's economic results relative to competitors, including return on investment, sales performance, financial results, profitability, debt management, and financing conditions. These indicators do not represent accounting performance measures; rather, they capture managers' perceptions of the firm's competitive position compared with other firms in the sector.

The cost efficiency dimension evaluates the firm's ability to compete through lower purchasing, coordination, transportation, and production costs. Finally, technological capability assesses the firm's ability to develop and apply technological resources through technology development, product and process improvement, project planning, equipment improvement, and information technology development.

The higher-order construct of competitiveness was specified as a reflective–reflective model. This specification follows the concept that competitiveness represents an underlying latent condition that is manifested through different but interconnected dimensions. Therefore, competitive performance, cost efficiency, and technological capability are considered manifestations of the firm's overall competitive condition rather than independent causal components. This approach is consistent with multidimensional construct theory, where higher-order constructs may capture different facets of a common underlying concept [74,75].

Finally, to measure competitiveness, we consider the criterion of Buckley et al. [5] based on the adaptation developed by Maldonado [72] and Maldonado-Guzmán et al. [73]. Consistent with Buckley's conceptualization, competitiveness was assessed as a multidimensional construct composed of competitive performance, cost efficiency, and technological capability.

3.2. Common Method Bias Assessment

Because this study collected perceptual data from organizational respondents through a structured questionnaire administered in person, the potential presence of common method bias (CMB) [76] was considered.

Therefore, procedural and statistical remedies were considered to minimize and assess potential common method effects. First, respondents were informed that their participation was voluntary and that the information provided would be used exclusively for academic purposes, ensuring confidentiality of responses. Second, the questionnaires were administered by trained interviewers who followed a standard protocol to ensure consistency during data collection. Third, the measurement scales were adapted from previously validated instruments, and the wording of the items was reviewed to ensure that the 33 items were understandable and relevant to the key respondents (owners or managers), who are directly involved in the firm's strategic decision-making process. The final instrument was organized into five sections, with the first two sections devoted to gathering general information about both the company and the participant, while the remaining sections

integrated the measurement scales of the constructs analyzed. All items were measured using a five-point Likert scale ranging from 1 (“totally disagree”) to 5 (totally agree).

In addition to these procedural remedies, statistical assessments were conducted. First, Harman’s single-factor test was performed as an initial diagnostic of common method variance [76]. The first factor explained 51% of the total variance. Although this value is slightly above the conventional 50% threshold, given the limitations frequently attributed to Harman’s single-factor test, an additional assessment was conducted using the full collinearity variance inflation factor (VIF) approach proposed by Kock [77]. The results indicated that all VIF values obtained for the predictor construct were 1.956 for both GMO and GEO. These values are substantially below the conservative threshold of 3.3 suggested by Kock [77] for detecting potential common method bias. Furthermore, they are also well below the threshold of 5.0 recommended by Hair et al. [78] for assessing multicollinearity in PLS-SEM models. Therefore, the results indicate the absence of problematic collinearity.

3.3. Sample and Data Collection

The sample consisted of Mexican companies from the agri-food and manufacturing sectors, each employing more than 10 employees. The sample was non-probabilistic for convenience, consisting of companies with active operations in Aguascalientes, Mexico.

The adequacy of the sample size was assessed using both the 10-times rule and statistical power analysis, as recommended in studies employing Partial Least Squares Structural Equation Modeling (PLS-SEM) [78]. According to the 10-times rule, the minimum sample size should be at least ten times the maximum number of structural paths directed at any construct in the model [79]. In the present study, the construct with the highest number of incoming paths is competitiveness, which receives two paths (from green market orientation and green entrepreneurial orientation), resulting in a minimum required sample size of 20 observations.

However, given the limitations of the 10-times rule, a more rigorous assessment was conducted using statistical power analysis following the guidelines proposed by Cohen [80]. Assuming a medium effect size ($f^2 = 0.15$), a significance level of 0.05, and a statistical power of 0.80, the minimum required sample size for a model with two predictors is approximately 68 observations. Therefore, the sample size used in this study ensures adequate statistical power to enhance the robustness of the model estimation [81].

A non-probabilistic sampling approach was used for this study. This method was selected because this study targets key informants with specific knowledge and decision-making authority within firms, such as managers or owners, who are directly involved in strategic and environmental practices. This approach is widely used in organizational and management research where access to knowledgeable respondents is critical for obtaining reliable and valid information [82].

Although non-probabilistic sampling limits the generalizability of the findings, it is appropriate for exploratory and theory-testing research designs in which the objective is to examine relationships between constructs rather than to make population-level estimations. It is also important to consider that the sampling strategy facilitates access to relevant organizational respondents, and it limits the statistical generalization of the findings. Therefore, the results should be interpreted considering the specific regional and sectorial context of the sample.

Data collection took place during September–December 2025 using a structured questionnaire, administered both in person and digitally. Two hundred surveys were completed by key respondents (owners/managers).

The methodological basis is supported by the Nature Resource-Based View (NRBV) Theory. The theory maintains that internal resources (tangible and intangible) constitute the

primary source of competitive advantage when they possess valuable, rare, and inimitable qualities, and are supported by organizational capabilities [4,51]. From this framework, GMO and GEO are conceived as intangible strategic resources that strengthen organizational capabilities to respond to environmental challenges, generate sustainable innovation, and improve competitive performance in agri-food and manufacturing sectors [10,13].

The NRBV broadens the classic perspective of the RBV by explicitly incorporating the natural environment as a source of strategic resources and capabilities [4]. This theory argues that long-term competitiveness depends not only on internal resources.

In this regard, the NRBV highlights three key dynamic capabilities, namely, pollution prevention, product responsibility, and sustainable development, which enable organizations to achieve sustainable competitive advantages through cost reduction, green innovation, and preferential access to environmentally sensitive markets [13,83].

From this perspective, GMO and GEO represent empirical manifestations of the capabilities described by NRBV. Pollution prevention is reflected in organizational practices that integrate sustainability into production processes, while responsible product management is linked to the development of eco-goods and eco-services that meet the expectations of green consumers. Finally, sustainable development is expressed in the adoption of innovative and collaborative strategies that promote long-term competitiveness without compromising natural resources [84,85].

According to this logic, Mexican agri-food and manufacturing companies can obtain sustainable advantages by internalizing the principles of the NRBV, transforming environmental pressures into opportunities for innovation and differentiation. GMO acts as an absorption capacity mechanism that allows companies to identify and respond to the ecological demands of the environment, while GEO enhances the dynamic capacity to generate innovative solutions oriented toward sustainability. Thus, both variables constitute intangible strategic resources that, according to the VRIO model, meet the conditions of value, rarity, inimitability, and organization, which are challenging for competitors to imitate [84,86].

In line with the fundamentals of the NRBV, this study adopts an explanatory structural equation model design (PLS-SEM) to empirically assess the causal links between higher-order constructs and their respective dimensions.

4. Results

The findings derived from the descriptive statistics related to the characteristics of the companies and their managers, obtained from the fieldwork carried out, are presented below.

As shown in Table 1, corresponding to the descriptive analysis of the firms, 35% of the companies have operated for over 31 years. Regarding the type of firm, there is a clear predominance of family-owned businesses, which represents 72% of the sample—more than double the proportion of non-family firms. The sectors surveyed were 62.5% agri-food companies and 37.5% manufacturing companies; 54% of companies had 11–50 employees, 25% had 51–250 employees, and 21% had more than 250 employees. Likewise, the results indicate that 65.5% of the companies analyzed have family-based management.

Regarding the descriptive analysis of the managers of the firms studied, as presented in Table 2, the most frequent gender is male, representing 88.5% of the sample and significantly exceeding the proportion of female managers. Concerning age, most managers are adults between 41 and 50 years old, predominantly with less than 15 years of tenure and holding a bachelor's degree or a master's degree.

Table 1. Descriptive statistics of the sample (firm-level).

Attribute	Condition	Frequency	%
Firm Age	1–10	32	16
	11–20	58	29
	21–30	40	20
	+31	70	35
Sector	Agri-food	125	62.5
	Manufacturing	75	37.5
Employees	11–50	108	54.0
	51–250	50	25.0
	+250	42	21
Type of Firm	Family-owned	144	72
	Non-family	56	28
Family Management	Yes	131	65.5
	No	69	34.5

Table 2. Descriptive results (key responds).

Attribute	Condition	%
Gender	Male	88.5
	Female	11.5
Age	30–40	9
	41–50	35.5
	51–60	29.5
	+61	26
Tenure	Less than 15 years	59.5
	16–30	28
	+31	12.5
Educational level	High school diploma	7
	Technical degree	23
	Bachelor's degree	33
	Master's degree	25.5
	Doctorate	11.5

4.1. Data Analysis of the Structural Model

Data analysis was conducted using Partial Least Squares Structural Equation Modeling (PLS-SEM), with the aid of Smart PLS 4 software [78]. This technique is appropriate for the present study due to its predictive orientation, its ability to estimate complex models with multiple simultaneous relationships, and its robustness in handling moderate sample sizes and non-normal data distributions [78]. Likewise, PLS-SEM is widely employed in business research when the objective is to examine structural relationships among latent constructs in real empirical contexts and within developing theoretical frameworks [87,88].

The measurement model and the structural model were assessed. In the latter, path coefficients and their statistical significance were estimated using bootstrapping with 5000 re-samples, following established methodological recommendations [78], thereby enabling the empirical testing of the research hypotheses. The results of this model are outlined below. The structural model begins with the examination of potential multicollinearity issues employing the variance inflation factor (VIF).

In addition, the significance and strength of structural relationships are evaluated through path coefficients and effect size (f^2), which indicate the influence of predictor constructs on endogenous variables. The model also includes (R^2), as it represents the

proportion of variance explained in each endogenous construct within the sample, the predictive relevance (Q^2).

The assessment of the model fit indicators is also examined, the standardized root mean square residual (SRMR) which assesses the average discrepancy between the observed and the model-implied correlations. Likewise, the unweighted least squares discrepancy (dULS) assesses the difference between the empirical covariance matrix and that implied by the model [89].

The higher-order construct was modeled as a reflective–reflective hierarchical component model to capture the multidimensional nature of competitiveness as a unified latent phenomenon. This specification assumes that the higher-order construct manifests itself through its underlying dimensions, which in turn are reflected by their respective indicators. The reflective–reflective approach is appropriate when all lower-order constructs represent different but highly correlated facets of the same conceptual domain, and when changes in the higher-order construct are expected to be reflected across all dimensions simultaneously [78].

4.2. Reliability

Indicator reliability was examined through standardized factor loadings, which indicate the extent to which each item is associated with its underlying latent construct. According to the methodological criteria proposed in prior research [90], values equal to or greater than 0.70 are deemed acceptable, as they suggest that the indicator accounts for a significant proportion—greater than 50%—of the variance of the construct it represents.

To assess the individual reliability of the indicators, the standardized factor loadings of each indicator relative to its corresponding latent construct were estimated. Table 3 presents the results obtained for the constructs of GMO, GEO, and competitiveness, allowing verification of the extent to which each indicator contributes to the measurement of its latent variable.

Table 3. Model factor loadings.

GMO		GEO		Competitiveness					
				Cost Efficiency		Competitive Performance		Technological Capability	
GMO_1	0.842	GEO1	0.861	CP3	0.805	FP1	0.859	TE1	0.774
GMO_2	0.795	GEO2	0.860	CP4	0.870	FP2	0.824	TE3	0.857
GMO_3	0.848	GEO3	0.808	CP5	0.860	FP4	0.815	TE4	0.818
GMO_4	0.840	GEO4	0.850	CP6	0.885	FP5	0.886	TE5	0.891
GMO_5	0.850	GEO5	0.832			FP6	0.854	TE6	0.866
GMO_6	0.856								
GMO_7	0.854								
GMO_8	0.822								
GMO_9	0.861								
GMO_10	0.846								

As shown in Table 3, all factor loadings exceed the recommended minimum threshold of 0.70 [78], confirming adequate individual indicator reliability. In particular, the items associated with GMO and GEO exhibit high and homogeneous loadings, evidencing consistent measurement of both constructs. Likewise, the dimensions comprising the competitiveness construct display robust values, supporting the adequacy of the selected indicators, which allows for a reliable continuation toward the evaluation of composite reliability and convergent validity of the measurement model.

4.3. Internal Consistency Reliability and Convergent Validity

After confirming the adequacy of the factor loadings, internal consistency and convergent validity of the first-order constructs were evaluated using Cronbach's alpha, composite reliability (rho_c), and average variance extracted (AVE). According to established methodological criteria [78,90], internal reliability is considered satisfactory when Cronbach's alpha and composite reliability values exceed 0.70, while convergent validity is confirmed when the AVE reaches values equal to or greater than 0.50, which explains an important proportion of the variance of its items.

Table 4 shows the results obtained for GEO, GMO and the dimensions that comprise the competitiveness construct, allowing verification of the psychometric quality of the scales employed.

Table 4. Reliability and convergent validity.

Construct	Alpha Coefficient	rho_c	AVE
GEO	0.898	0.924	0.710
GMO	0.954	0.960	0.708
Competitiveness—CP	0.877	0.916	0.732
Competitiveness—FP	0.902	0.927	0.719
Competitiveness—TE	0.897	0.924	0.709

Evidence from Table 4 demonstrates all analyzed constructs and dimensions exceed the minimum thresholds recommended in the literature, with alpha coefficient (0.877–0.954) and rho_c (0.916–0.960) values above 0.70 and AVE (0.708–0.732) values greater than 0.50, indicating satisfactory internal consistency and convergent validity [78]. In particular, the constructs of GEO and GMO exhibit high levels of consistency, while the dimensions of competitiveness present robust indicators. These results support the soundness of the measurement model and allow progression to the evaluation of the structural model.

4.4. Discriminant Validity

To assess discriminant validity, two procedures widely recognized in the PLS-SEM literature were implemented, namely, the Fornell–Larcker criterion and Heterotrait–Monotrait (HTMT) matrix, following the methodological recommendations [78].

According to the Fornell–Larcker criterion, discriminant validity is confirmed when the square root of the (AVE) for each construct, presented on the diagonal, exceeds the correlations with other constructs. Table 5 shows that this condition is met for all the constructs analyzed, indicating adequate conceptual differentiation among the latent variables and supporting the discriminant validity of the model.

Table 5. Discriminant validity.

	GEO	CP	FP	GMO	TE
GEO	0.842				
CP	0.655	0.855			
FP	0.686	0.667	0.848		
GMO	0.699	0.736	0.718	0.842	
TE	0.722	0.722	0.734	0.731	0.842

Table 6 shows that the estimated Heterotrait–Monotrait (HTMT) index values among the constructs GEO, GMO, and the dimensions of competitiveness remain below the critical threshold of 0.85, in accordance with the methodological criteria proposed [78]. These results indicate that each construct measures an empirically distinct concept, thereby indi-

cating the discriminant validity of the measurement model and the adequate differentiation among the latent variables analyzed.

Table 6. HTMT index.

	GEO	CP	FP	GMO	TE
GEO					
CP	0.736				
FP	0.763	0.747			
GMO	0.753	0.803	0.771		
TE	0.806	0.812	0.815	0.789	

Overall, the results obtained demonstrate that the measurement model exhibits solid psychometric properties. The standardized factor loadings exceed the recommended thresholds, and the results confirm adequate internal consistency. Furthermore, the (AVE) supports convergent validity, and the Fornell–Larcker and HTMT corroborate discriminant validity among the latent variables.

4.5. Collinearity Statistics

Once discriminant validity was confirmed, and potential collinearity among the indicators was examined by calculating the variance inflation factor (VIF). In accordance with the methodological guidelines established [78,90], VIF values below 5.0 are considered acceptable.

The items present values are below 5.0, which is considered acceptable in PLS-SEM models [78,90] (see Table 7).

Table 7. Collinearity statistics.

Variable	VIF
GEO1	2.798
GEO2	2.773
GEO3	2.011
GEO4	2.493
GEO5	2.263
CP3	2.406
CP4	2.546
CP5	3.299
CP6	2.886
FP1	3.408
FP2	2.581
FP4	2.116
FP5	3.627
FP6	3.191
GMO_1	3.550
GMO_2	3.119
GMO_3	3.170
GMO_4	3.633
GMO_5	3.608
GMO_6	4.410
GMO_7	4.011
GMO_8	2.737
GMO_9	3.844
GMO_10	3.219
TE1	1.836
TE3	2.885
TE4	2.533
TE5	3.431
TE6	3.415

4.6. Hypothesis Testing/Results of the Structural Model

To assess the significance and relevance of path coefficients, it is necessary to determine the effect sizes (f^2), the predictive relevance (Q^2), and determination coefficients (R^2).

The R^2 value was 0.733 for competitiveness with a variance of 73.33% in this variable explained by the GMO and GEO. The Q^2 values were positive and above zero (0.725), indicating that the model demonstrated strong predictive capability [91]. An SRMR value of 0.08 indicated an acceptable model fit according to the recommended threshold for PLS-SEM (Table 8) [91]. Additionally, the d_ULS value obtained was 6.15, which was included as a complementary descriptive measure of discrepancy between the empirical correlation matrix and the model-implied correlation matrix. However, bootstrap confidence intervals (HI95) for d_ULS were not available due to the hierarchical second-order model specification using the repeated-indicators approach, a condition commonly associated with composite-based PLS-SEM models. Therefore, in this study, the d_ULS index was interpreted as a descriptive indicator, while SRMR was considered the primary global model fit criterion. This interpretation is consistent with the recommendations of Dijkstra and Henseler [92], who argue that d_ULS should not be evaluated using absolute cut-off values but rather through comparisons with bootstrap-derived reference values. Since such reference values (HI95) were not available for the hierarchical repeated-indicators specification employed in this study, the d_ULS value was not used as a criterion for model rejection.

Table 8. Hypothesis testing of the model.

Hypothesis	Structural Paths	β	t -Values	p -Values	Confidence Interval 95% (f^2)	Decision
H1	GMO $\rightarrow$ COMP	0.534	(9.085)	(0.001)	(0.416; 0.644) 0.552	Accepted
H2	GEO $\rightarrow$ COMP	0.395	(7.070)	(0.001)	(0.285; 0.509) 0.302	Accepted
Endogenous construct		Adjusted R^2		Model fit	Index	
COMP		0.733		SRMR	0.08	
				d_ULS	6.15	

The bootstrap confidence intervals obtained for the structural relationships did not include values of zero, confirming the statistical significance and stability of the proposed relationships within the model. Specifically, the relationship between GMO and competitiveness presented a 95% confidence interval of (0.416; 0.644), while the relationship between GEO and competitiveness was (0.285; 0.509). In PLS-SEM a confidence interval that does not contain zero indicates that the path coefficient is statistically significant at the established confidence level. Furthermore, these intervals suggest that the estimated effects are positive and exhibit an acceptable degree of precision and robustness within the analyzed sample [78].

The findings reported in Table 8 suggest that all relationships proposed in the model are positive and statistically significant ($p < 0.001$). GMO exerts a significant effect on competitiveness ($\beta = 0.534$; $t = 9.085$), suggesting that organizations systematically incorporate the environmental requirement of their customers and the competitive environment can strengthen their competitive position. This finding supports Hypothesis 1, confirming that a strategic orientation toward green markets constitutes a relevant mechanism for improving business competitive performance with an (f^2) of 0.552. Similar effects were found in the study conducted by Le [93].

Likewise, GEO shows a positive and significant impact on competitiveness ($\beta = 0.395$; $t = 7.070$; $p < 0.001$), demonstrating that entrepreneurial capabilities oriented

toward innovation, proactiveness, and risk-taking with an environmental focus play a determining role in strengthening firms' competitiveness. This result confirms Hypothesis 2 with an (f^2) of 0.302 and suggests that green entrepreneurial strategies not only complement market orientation but also represent a key driver for generating sustainable competitive advantages in business contexts that are increasingly demanding in environmental matters. Similar effects were found in the studies conducted by Gu et al. [64], Ameer and Khan [65], Shou et al. [67], Wu [35] and Mondal [39].

5. Discussion

The findings of this study provide evidence of how green strategic orientations contribute to firms' competitiveness. In this research, competitiveness is conceptualized as a multidimensional strategic construct reflected through three dimensions: competitive performance, cost efficiency, and technological capabilities. From the perspective of the Natural Resource-Based View [4,13], GMO and GEO represent capabilities that enable firms to respond to environmental challenges while strengthening their competitive position.

The relationship between green market orientation and competitiveness can be explained by the ability of firms to generate and use environmental market knowledge in their strategic decisions. Firms with stronger GMO capabilities are better positioned to understand changing customer expectations, anticipate sustainability requirements, and adapt their products and processes accordingly.

Previous empirical studies have mainly examined GMO in relation to specific outcomes. Tjahjadi et al. [19] found that green market orientation contributes to business performance through green innovation capabilities, while Fatoki [21] demonstrated its relevance for environmental and social performance in an emerging economy context. Extending these studies, the present research suggests that GMO contributes to competitiveness by strengthening firms' ability to improve competitive performance, achieve greater cost efficiency, and develop technological capabilities in response to sustainability-oriented market demands.

Regarding the discussion of previous outcomes in relation to GEO, it has been found to promote innovation and sustainability outcomes [64,65,67]. In this sense, the contribution of this study is the incorporation of the construct of competitiveness into a model that allows us to enter into the discussion on the subject, since the results indicate that GEO promotes competitiveness since it is a determinant in firms that allows transforming environmental pressure into opportunities to renew strategies that develop their competitive capacities.

However, the results should be interpreted within the empirical boundaries of this study. The evidence was obtained from firms located in Aguascalientes, Mexico, and therefore provides contextual insights rather than evidence that can be automatically generalized to all Mexican firms or other emerging economies. Future research should examine whether these relationships remain consistent across different regions, sectors, and organizational contexts.

6. Conclusions

The findings contribute by providing evidence from an underexplored regional context within an emerging economy regarding the relationship between GMO and GEO and competitiveness among firms in the analyzed context (agri-food and manufacturing companies). However, given the regional and sectorial characteristics of the sample, these results should not be interpreted as representing all Mexican firms.

From a theoretical perspective, the findings support the premises of the Natural Resource-Based View (NRBV), showing that GMO and GEO operate as valuable intangible resources that are difficult to imitate and organizationally exploitable. In line with this

approach, GMO enables agri-food and manufacturing companies according to the results of the sample of companies analyzed to systematically identify and respond to ecological market demands, while GEO enhances dynamic capabilities to innovate, take risks, and act proactively under an environmental logic. The greater magnitude of the effect of GMO on competitiveness suggests that responsiveness to environmentally oriented demands plays a more prominent role, while an entrepreneurial posture contributes positively by translating such information into innovative and sustainable actions.

6.1. Theoretical Implications

This study offers important contributions to the literature on green strategic management. It advances prior research by integrating GMO and GEO within a unified analytical framework. This research conceptualizes them as complementary capabilities that jointly influence firm competitiveness, thereby providing a more holistic perspective. This study extends the NRBV by empirically demonstrating how environmentally oriented strategic capabilities translate into competitiveness. In contrast to prior research that has largely treated NRBV as a conceptual framework, this study operationalizes its core assumptions and provides empirical evidence of its applicability in real organizational settings.

6.2. Managerial Implications

Since GMO exhibited a substantially stronger contribution to competitiveness than GEO, managers operating under resource constraints may achieve greater competitive gains by first strengthening market-oriented environmental capabilities. This includes investing in systems for monitoring green consumer preferences, tracking competitors' sustainability initiatives, and anticipating regulatory changes. While entrepreneurial initiatives remain important for fostering innovation and long-term adaptability, the findings suggest that firms may obtain more immediate competitive benefits when environmental strategies are closely aligned with market expectations. Consequently, managers should view GMO as a foundational capability that enhances the effectiveness of other sustainability-oriented initiatives, including those associated with entrepreneurial behavior.

6.3. Limitations and Future Research

It is important to consider some limitations of this study. First, the method used to obtain the sample was through convenience sampling and was restricted to firms located in Aguascalientes, Mexico. Second, the analysis focused on two sectors, which may limit the transferability of findings to firms operating in different industries. Future research should examine the proposed model using broader samples that include firms from different Mexican regions, industries, and emerging economies. Another limitation was the use of perceptual scale for the measurement of the concept of competitiveness; therefore, we recommend that in future research the use of objective scales would be better to contrast the results. Future studies could replicate and extend this model using probabilistic sampling approaches and samples from different regions of Mexico and other emerging economies to evaluate the robustness and transferability of the proposed relationships.

It would be convenient to incorporate additional variables into the model, including incorporating factors such as the type of companies, family or non-family; the gender of the respondents; and the size of the companies or various business sectors. This would enrich the knowledge of whether these results would be similar in different contexts.

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Abbreviations

The following abbreviations are used in this manuscript:

AVE	Average Variance Extracted
TE	Technological Capability
CP	cost efficiency
CSR	Corporate Social Responsibility
EO	Entrepreneurial Orientation
FP	Competitive Performance
GEO	Green Entrepreneurial Orientation
GMO	Green Market Orientation
GSCM	Green Supply Chain Management
HTMT	Heterotrait/Monotrait Matrix
MO	Market Orientation
NRBV	Natural Resource-Based View
PLS-SEM	Partial Least Squares Structural Equation Modeling
RBV	Resource-Based View
SDGs	Sustainable Development Goals
SMEs	Small- and Medium-Sized Enterprises
VIF	Variance Inflation Factor

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