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Environmental Performance and Green Culture: The Mediating Effect of Green Innovation. An Application to the Automotive Industry

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Abstract: Globalization and the ever-growing presence of technology have paved the way for better developmental opportunities in society. Nonetheless, these have also been to the detriment of the environment as well as sustainable development. The aim of this study is to discover the mediating effect of green innovation with regard to the relationship which exists between green culture and environmental performance in the State of Mexico's automotive sector. The research hypotheses were formulated following an extensive study of the literature available and were based on resource- and capability-based theory, specifically, the natural-resource view of the firm (NRBV). The design of the study was non-experimental and cross-sectional with a confirmatory reach, applied to a sample of 157 observations. The proposed theoretical model was tested using partial least squares structural equation modeling (PLS-SEM). The findings provide empirical evidence that green innovation acts as a mediator variable on the relationship between green culture and environmental performance. The scientific merit of the study is found in its proposal of a hierarchical second-order model, categorized as reflective-formative, and the study's confirmation of the role of green innovation as a mediating construct. Therefore, the findings herein can be considered as complementary to the existing body of knowledge in the field. The practical implications derived from this study will contribute to sustainable development and expand knowledge in the following areas: Government institutions, companies that operate in the sector, decision makers, academics, and practitioners who are working on this issue at different levels.

Keywords: environmental performance; green culture; green innovation; mediating effect; PLS-SEM; hierarchical component models

1. Introduction

A growing demographic, the ever-increasing presence of technology, global economics, and the exploitation of natural resources have caused environmental problems to intensify. Problems related to resources and environment have become the main limiting factors for sustainable economic development and have become a concern for society [1]. Economic growth has been believed to be at odds with sustainable environmental practices for many years. However, this is a constant challenge which obliges companies to act ecologically in terms of trade, industry, and service-providing. The importance of technological challenges grows proportionally to companies' implementation of green innovation and sustainable development practices. Nonetheless, typically, green codes of practice are only implemented when companies believe they will be of financial benefit and will give them a

competitive advantage [2]. Environmental care is growing in importance within enterprises and has become an essential part of company strategy and outlook [3].

Porter [4] believes that organizations can obtain better results by applying green initiatives which reduce production costs and increase economic efficiency [5]. It is for this reason that environmental initiatives are recognized as an important key for sustainability [6]. It is possible that adopting and implementing green culture could lead to improved environmental performance. In the literature of recent years, little empirical evidence has been found of green innovation and environmental performance conferring a competitive advantage to companies [1,2]. The current trend is for manufacturers to focus on new energy-efficient product designs. Having said that, in Mexico, sustainable codes of practice are an area of opportunity.

In the 21st century, interest in sustainability and sustainable development has been increasing as a consequence of the acceleration and complexity of the global economy and of the need to create a greater awareness of environmental issues. These include the use and exploitation of resources [7]. This is the only way of leaving a greener world for future generations and is part of the world trend towards sustainable development and towards better legal compliance regarding environmental care [8]. In the near future, environmental problems may become more serious and, facing that, it is necessary to focus economic activity on environmental sustainability. In accordance with this, a view has emerged based on natural resources as an extension of the resource- and capability-based theory [9–11], which comprises three interconnected strategies, as follows: Prevention of pollution, administration of products, and sustainable development. The aforementioned strategies facilitate environmentally sustainable economic activity and/or confer a sustainable competitive advantage [12]. Currently, many companies are beginning to comply with their obligations concerning environmental problems. This is due to the need to better manage environmental performance in order to achieve a competitive advantage [13].

In consequence, green culture is an important strategic determinant for green innovation and for gaining a competitive advantage [14]. In recent years, different studies have been conducted on green practices, in which a competitive advantage has been gained through green culture at the organizational level, green human resources practices [15], environmental capabilities [16], environmental performance, green supply chains [17], green intellectual capital [18], ecological learning [19], innovative performance and green products, strategies for green innovation, green value chains, green human resources management, and green information system infrastructure [20,21]. This indicates that a growing consciousness surrounding green practices has been observed in companies and businesses. Furthermore, as the world globalizes, these companies are choosing new environmental practices, although currently this occurs chiefly in certain countries. For this reason, there was a need to do this study. This study aims to do the following: (a) Examine the effect of green culture on green innovation and environmental performance, and (b) find the mediating role of green innovation in the relationship between green culture and environmental performance.

Against this background, and supported by resource- and capability-based theory (specifically the natural resources-based view (NRBV)), this study attempts to give answers to the following research questions: (1) How does green culture influence green innovation and green performance? (2) Is green innovation a mediator variable in the relationship between green culture and green performance? The methodology used in this study has a non-experimental cross-sectional design, carried out in automotive companies in the State of Mexico, with a sample size of 157.

The automotive industry in Mexico is one of the most important in terms of the economy and economic development. This sector was chosen mainly due to following economic indicators, which featured in a 2018 National Institute for Statistics and Geography report (Instituto Nacional de Estadística y Geografía). The automotive industry represented 3.7% of national GDP, 20.2% of GDP from manufacturing, and 83% of light vehicle production was for export. The main strength of Mexico's automotive industry is its investment in innovation and design. This is achieved by means of modernization and the use of technology in processes and products, ensuring competitiveness in a

global market. In spite of its importance, this industry impacts heavily on the environment. Given the growing importance of environmental concerns within company strategy and the fact that green culture is an ideology which promotes sustainable economic and scientific development, these arguments point to the importance and relevance of this study.

Regarding the analysis technique, partial least squares structural equation modelling (PLS-SEM) was used to evaluate the proposed theoretical model. The justification for electing PLS as the analytical technique is based on its focus on composites. This allows analysis of smaller complex models and hierarchical structures, coupled with mediation and moderation [22]. In this specific case, the proposed research model is a second-order hierarchical model, categorized as reflective-formative with a mediator variable.

Following an exhaustive search of the literature, this study is the first to examine the mediating effect of green innovation in terms of green culture and environmental development in Mexico's automotive industry. This is modelled as a second-order composite in the field of environmental performance. This adds to the body of knowledge for environmental care and sustainability in a sector so fundamental for national economic growth. In terms of the main theoretical contributions, other than the proposed model, is the empirical confirmation of the mediating effect of green innovation. The findings confirm that green culture has a significant positive effect on environmental performance and, additionally, green innovation is a mediating variable for both of them. For the reasons outlined above, the presence of complementary partial mediation is confirmed.

The rest of the study is organized as follows. Firstly, the scientific literature on variables and their relationships was studied. The objective of this is to explain the argument related to the conjecture that green culture influences environmental performance and that green innovation mediates this relationship. Secondly, the methodology of the work and the statistical results (obtained via the use of PLS-SEM) are described, which details both the relationship and the mediating effect. In the final section of the document, the main conclusions and findings, and their limitations and practical implications, are explained. These research findings will contribute to the body of knowledge theoretically and practically. The purpose of this is to influence decision makers in the automotive industry to adopt green culture for the benefit of caring for the environment and for sustainable development.

2. Conceptual Framework and Hypotheses

Over many years, the resource- and capability-based theory has been a theoretical axis in strategic management. It has emphasized that a competitive advantage depends on resources and internal organizational capabilities. However, in recent years, a new theoretical approach has emerged known as "the resource-based view" [12]. The resource-based view proposes an outlook based on natural resources being a physical (not legal) requirement. Through the use of natural resources, this outlook can confer a competitive advantage. The conceptual framework of this approach lies in new strategic capabilities for the prevention of pollution, the management of products, and sustainable development, impelling environmental forces and conferring a competitive advantage.

2.1. Green Culture

Green culture is a current environmental ideology promoting sustainable economic and ecological development, based on science, politics, and aesthetics. Some years ago, companies began taking this approach into account when implementing corporate social responsibility. Companies realized that this paradigm shift would affect market behaviour and, as a result, affect sales, leading to increased profits [3]. This ecologically-focused change allowed for new ideas to interlink, pushing towards sustainability or social consciousness in accordance with the company's values. In other words, organizational culture would be strengthened by the incorporation of this green approach.

The literature on ecological management states that in order to adopt sustainable behaviour, organizations must establish strategic actions that go beyond agreed-upon commitments. This includes

the adoption of new environmental values, beliefs, and behaviours. The development of sustainability depends, in great measure, upon the change to green culture that organizations promote [23].

Organizational culture is considered an intangible resource which, from a theoretical perspective, plays a key role in moving an organization towards greater sustainable development and better environmental management [8]. In general terms, culture is a combination of standards and values that are shared and presented throughout the whole organization and which can take different forms according to the characteristics of the company. High tech companies promote innovative technology, while others adapt it to their own purposes as a means of strengthening their culture [24]. According to Hitkaa et al. [25], corporate culture is a combination of the concepts, beliefs, attitudes, and values that can propel the organization through time as a driving force of decisions and actions. This can lead to an improvement in the performance of the organization, along with success and recognition. These are part of the acceptance and adaptation of the prevailing culture. In line with these statements, organizations that possess a corporate culture in which employees are encouraged to promote green practices, such as culture, innovation, and performance, will be perhaps precisely those which achieve a competitive advantage in accordance with the view of the company based on natural resources. Green culture involves a new perspective for organizations which are concerned with environmental management for the benefit of the environment as an economic alternative for organizational operations.

Therefore, organizational culture has an important role in companies which carry out green innovation practices as part of the world-wide trend towards more responsible ecological behaviour. This is becoming increasingly present in organizations which are concerned about promoting sustainable development [26]. This study tackles organizational culture from the Denison frame of reference [27] by means of four cultural traits which indicate organizational effectiveness, as follows: Involvement culture, consistency culture, adaptability culture, and mission culture. Involvement culture is about how effective organizations empower their employees, build work groups, and emphasize human development. In this way, employees, managers, and directors feel committed to their work and company objectives. Consistency culture is an indicator of a strong, stable, and value-consistent culture in which leaders and collaborators develop their negotiating abilities in order to reach agreements, even when there may be differences of opinion. This enhances stability and efficiency within an organization. By adopting adaptability culture, organizations acquire the ability to adapt to the different challenges they face in their environment in order to provide their clients with value. Finally, mission culture makes note of the fact that successful organizations have a clear purpose when setting strategic goals and organizational targets. They adhere to a vision of how they see themselves in the future.

2.2. Environmental Performance

Supported by the view of companies based on resources, Russo and Fouts [28] postulate that environmental performance is positively linked to an industry's growth. The environmental performance of an organization is based on the level of polluting emissions caused by that company [29]. In accordance with these affirmations, environmental performance is probably achieved when the industry redesigns its productive processes, uses clean technologies, and minimizes wasted resources or puts them to good use. In this competitive, globalized, and technological economy, companies ought to promote environmental practices from the perspective of environmental development. The purpose is to take care of the environment and encouraging green culture and innovation that will be sustainable for the economic health of the organization. In recent years, the relevant literature has provided evidence regarding the interest of researchers in environmental performance [8,30–32].

2.3. Green Innovation

Currently, due to the worldwide concern for the environment, different companies are choosing to adopt ecological practices in business. Unfortunately, however, this is not the case in developing countries. Nonetheless, it is important that companies adopt this approach, because in this way they can take care of the environment and reduce pollution [33]. So-called "green innovation" can

be applied to product design, processes, and technologies related to saving energy or in processes affecting energy efficiency. Thus, green innovation has become a strategic tool for achieving the sustainable development of industry, resulting in the improvement of the environmental situation [34]. Environmental impact has been with us since the Industrial Revolution, but now it has become much more serious and on a greater scale. It is considered one of the biggest problems facing the world today and although in recent years corrective greener policies have been implemented, it is necessary to take even more preventative measures [35].

2.4. Green Culture, Green Innovation, and Environmental Performance

Greater recognition of the impact of daily activities on the environment and the promotion of green practices has grown at the personal and corporate level. This has been achieved through environmental culture as a corporate strategy [36]. The understanding of organizational culture must therefore drive the improvement of organizational performance. Understanding organizational culture is a task in which managers must provide their employees with the values, standards, and principles that govern the organization. Organizational culture has a positive impact on the performance of employees who are committed to and share the same standards, values, behaviors, and beliefs as the organization [37]. The culture must be shared and learned within the organization. When green culture affects the awareness of employees in terms of green innovation, it is because they manifest a commitment to ecology and sustainability in order to reduce environmental damage [8]. In a globalized economy, in which competition between companies is constantly on the rise, green innovation contributes to the competitiveness of companies and to sustainability. This owes to the fact that it has a positive impact on the results and organizational output, and also on financial performance and the environmental results of the company [38,39].

On the other hand, empirical evidence affirms that a culture of innovation has a positive effect on performance [40]. In this way, green innovation plays a mediating role between environmental ethics and conferring a competitive advantage [34]. In other words, when green innovation is the central axis supported by the green culture of the organization in order to enhance environmental results, it will probably be a determining factor as well as a mediating construct. If company-based green innovation correlates positively with company performance (this should not take normative regulation into account exclusively), it is because there are other factors driving the company from within. This is due to the fact that it is a culture which is based on values which ensure economic sustainability [38]. When green innovation is promoted within a company, it becomes a defining feature of the enterprise and the results are seen in the company's environmental performance [41]. Furthermore, when a company views green codes of practice as a part of company strategy and as part of employees' ecological ethos, the results will be seen in the enterprise's environmental performance [30].

Based on these arguments, the following hypotheses are proposed:

Hypotheses 1 (H₁). *Green culture has a direct positive effect on environmental performance.*

Hypotheses 2 (H₂). *Green culture has a direct positive effect on green innovation.*

Hypotheses 3 (H₃). *Green innovation has a direct positive effect on environmental performance.*

Hypotheses 4 (H₄). *Green innovation mediates the relationship between green culture and environmental performance.*

Figure 1 graphically shows the model used in this research.

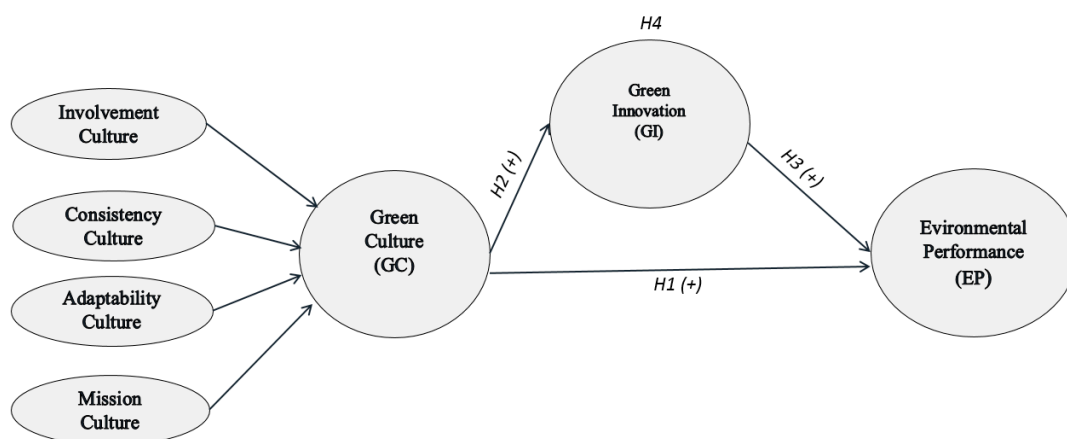


Figure 1. Research model. Notes: (1): Green Culture is a Higher Order Construct (HOC). (2): Involvement Culture, Consistency Culture, Adaptability Culture and Mission Culture, they are Lower Order Constructs (LOC).

3. Methodology

3.1. Design of the Research

This study used a non-experimental cross-sectional research design. The type of research or scope is confirmatory. The objective is to understand the causal relationships among the latent variables or theoretical concepts, as well as to perform a goodness of fit test of the global model based between the empirically observed correlations and those that are implicit because of the model [42]. Confirmatory studies are the last stage in the investigation. The aim of these is to understand the relationships between constructs based on the theory and goodness of fit tests are required.

3.2. Sample

The sample consists of 157 observations collected from the automotive sector of the State of Mexico. To determine the minimum required sample size, the study was based on the recommendations of Nitzl [43]. That is to say, for a statistical power of 0.80, four predictors, an average effect, and a significance of 0.05, a size of 85 is recommended. According to this, our sample of 157 is appropriate for supporting the research model. The sampling process was aimed at mid-level managers and executives, who were the key human capital in the organizational processes promoting green practices and environmental performance. All the data were collected in the first three months of 2019 and analyzed in April, May, and June of the same year. Additionally, competition in this industry is increasingly intense and, at the same time, is one of the greatest polluters in emerging economies. The sample profile of respondents reported that 76.7% were men. Regarding the level of education of the mid-level managers and executives, more than 50% answered that they had studied for a master's degree (68%). Finally, the average age of the respondents was revealed to be around 37 years old.

3.3. Measures

The questionnaires were designed in accordance with the literature in the field. Pre-validated levels of measurement were used. Nevertheless, some items had to be adapted for a Mexican audience. These were tested and validated. Green culture is described in Yang et al. and Denison [8,27] as comprising four dimensions, as follows: "Green culture involvement", "green culture consistency", "green culture adaptability", and "green culture mission". Regarding the latent variable or construct "green innovation", the items supported in Chen et al. [41] were operationalized. In order to measure "environmental performance", the items described in Chen et al. [30] and Kuo and Chen [31] were

also operationalized. All items were measured on a five-point Likert scale (1 = totally disagree and 5 = totally agree). Appendix A, lists the questionnaire items.

3.4. Data Analysis

This research used structural equation modeling (SEM), which allows for graphic modelling and estimating the structures of the research model supported by theory. Structural equation modelling is a second-generation, multi-variable, and analytical technique which uses statistical methods simultaneously applied to complex relations between several latent or construct variables.

Currently, there are two subtypes of SEM, as follows: (1) Based on the covariance, CB-SEM [44] and (2) based on the variance, PLS-SEM [45]. This second one was used to estimate the proposed model, in which it is a method for estimating complex models based on composites. In recent years, this method has been used increasingly often in social science disciplines, information systems, and business disciplines [12]. Therefore, PLS-SEM allows users to work with reflective, formative, and composite models [46]. In addition, it is used in different types of research, as follows: Predictive, descriptive, exploratory, explanatory, and confirmatory [47]. With the use of PLS-SEM, more sophisticated models have been created with second-order constructs, (also known as higher-order constructs, multidimensional constructs, or hierarchical component models (HCMs)).

To estimate and evaluate the model that has a second-order construct formed by first-order reflective constructs, the process took place in two stages. In the first, the model was run with first-order reflective constructs (common factor model), through PLS (PLS consistent) to obtain consistent estimates [46]. That is to say, the PLS estimation algorithm corrected estimates when applied to reflective constructs [46]. The quality criterion for the measurement model was verified in order to be able to proceed with the following phase. In the second stage, the scores of the first-order construct (latent variables) were used to construct a model containing the second-order construct (green culture) in such a way that the research model was tested with a second-order formative construct and two first-order constructs. That is to say, it is a type II HCM, one of those most used in empirical applications [22].

Deciding that the constructs should be measured in a reflective or formative way is a fundamental point that can avoid erroneous specification of the measurement model. In this regard, a confirmatory tetrad analysis (CTA-PLS) was carried out in order to have an empirical foundation additional to the theory about the measurement of the second-order construct. The confirmation analysis of the tetrads in PLS allowed the researchers to empirically evaluate whether the specification of the measurement model chosen based on the theoretical foundations was supported by the data [48]. An erroneous specified measurement model is a problem for the validation of SEM results [49]. However, the primary means for deciding whether to specify a measurement model in a reflective or formative way is through theoretical reasoning. Any change of measuring perspective must be based on theoretical conditions [50].

4. Results

To determine the validity of the research model, the methodology proposed by Henseler et al. [51] was followed. Henseler et al. state that the results of the PLS path model can be globally evaluated (in other words, for the whole model) and partially evaluated, i.e., for the measurement models and the structural model.

4.1. Evaluation of Global Model Fit

The global goodness of fit of the model must be the starting point for the evaluation of the research model. The purpose is to verify whether the model fits the data [51]. Additionally, the type of confirmatory research requires the evaluation of the goodness of fit of the model [42]. In this regard, the global model fit is evaluated by three measures suggested in the PLS-SEM context. First of all is the standardized root mean square residual (SRMR), which is defined as the discrepancy between

the matrix of observed correlations and what is implied by the theoretical model. As an absolute measure of fit, a value less than 0.08 is, generally, considered a good fit [52]. Secondly, two more discrepancy measures were evaluated, as follows: Unweighted least squares discrepancy (d_{USL}) and geodesic discrepancy (d_G), which were compared to the 95% and 99% percentile of their distribution. This implies that the confidence interval must include the original value, which means that the limit of the confidence interval must be higher than the original value to which it is being compared. That is to say, if the results of these discrepancy tests exceed those percentiles based on bootstrapping, the accuracy of the model is doubtful [49]. With these arguments, Table 1 shows a suitable global model fit. Given that SRMR is an absolute measure of fit of the model, in our case, applied to confirmatory trials, a SRMR of 0.050 is a very good fit. It is well below the established threshold.

Table 1. Global model fit.

Criterion	Value	HI95	HI99
SRMR			
<i>Saturated</i>	0.050	0.049	0.054
<i>Estimated</i>	0.050	0.049	0.053
d_{USL}			
<i>Saturated</i>	0.262	0.250	0.303
<i>Estimated</i>	0.262	0.250	0.299
d_G			
<i>Saturated</i>	0.208	0.195	0.230
<i>Estimated</i>	0.208	0.194	0.227

Notes: Global model fit measures: Standardised root mean squared residual (SRMR), unweighted least squares discrepancy (d_{USL}); geodesic discrepancy (d_G); bootstrap-based 95% percentil (HI95); bootstrap-based 99% percentile (HI99).

4.2. Measurement Model

The measurement model evaluates the contribution of each indicator with the associated construct. In this case, a measurement model that would present reliability and validity was sought. For this reason, the procedure was carried out in two stages. In the first, the first-order model was evaluated as a reflective type. Once validity and reliability were obtained, the second stage consisted of evaluating the “green culture” second-order construct as a formative type. Tables 2–7 summarize the reliability and validity of measurement models. Table 4 shows the reliability and validity of the results for the first-order measurement models (categorized as: reflective) in accordance with Hair et al. [50]. All outer loadings are well above the established threshold of 0.70. Regarding Cronbach’s Alpha and the composite reliability, they are also above the common minimum threshold level of 0.70. The average variance extracted (AVE) is seen as a convergent measurement of validity. It is the degree in which a latent construct explains the variance of its indicators. This also converges with the established threshold greater than 0.50.

These results confirm the validity and reliability of the measurement model. Reliability measures the consistency of a measurement. This means, we observe consistent results from items from the same test. Convergent validity, on the other hand, was calculated by means of average variance extracted (AVE). Regarding the discriminant validity, this represents the degree to which one construct differs from another. Discriminant validity indicates that a construct measures a unique phenomenon which is not represented by other constructs in the model. Tables 5–7 give the results. The Fornell–Larcker criterion is considered a traditional approach to assessing discriminant validity. However, a more recent measurement in the PLS-SEM context is the heterotrait-monotrait ratio (HTMT). The results of which are below the suggested threshold value of 0.85 or 0.9 [53].

Table 2. Descriptive statistics (Indicators data correlations with composite model).

CA	CA	CC	CI	GI1	GI2	GI3	GI4	GI6	GI6	GI7	MC	P1	P2	P3
	1													
CC	0.558	1												
CI	0.630	0.677	1											
GI1	0.418	0.662	0.474	1										
GI2	0.480	0.504	0.517	0.520	1									
GI3	0.543	0.545	0.56	0.545	0.597	1								
GI4	0.581	0.517	0.558	0.444	0.520	0.583	1							
GI5	0.477	0.609	0.598	0.512	0.389	0.646	0.458	1						
GI6	0.498	0.605	0.622	0.488	0.468	0.597	0.600	0.619	1					
GI7	0.519	0.560	0.553	0.460	0.431	0.464	0.517	0.492	0.448	1				
MC	0.384	0.475	0.641	0.303	0.341	0.441	0.411	0.512	0.444	0.473	1			
P1	0.435	0.474	0.452	0.455	0.341	0.333	0.316	0.314	0.380	0.457	0.307	1		
P2	0.565	0.680	0.615	0.623	0.536	0.565	0.525	0.527	0.601	0.462	0.470	0.505	1	
P3	0.522	0.551	0.561	0.493	0.414	0.414	0.427	0.533	0.502	0.387	0.341	0.456	0.552	1

Table 3. Descriptive statistics (Latent Variable Correlations).

Relation	Original Sample	Sample Mean	Standard Deviation	t Statistics	p Value
GI→GC	0.885	0.888	0.031	28.172	0.000
EP→GC	0.880	0.883	0.040	21.813	0.000
PER→GC	0.898	0.903	0.045	20.050	0.000

To confirm the HTMT, a bootstrapping analysis was also run to derive a distribution of the HTMT statistic, and the confidence interval with the bias corrected was checked, where the confident interval must not contain the value 1 [50]. Henseler et al. [53] proposed viewing the heterotrait-monotrait ratio (HTMT) as a measurement for all correlations between indicators of different constructs and those with reference to the mean. This can be calculated by way of the PLS algorithm and statistical inference through the bootstrap confidence interval. This represents the range in which the true HTMT population value can be calculated. Therefore, a confidence interval with a value of 1 does not exhibit discriminant validity. On the other hand, if the value 1 is outside of the range of the interval, the conclusion is that both constructs are empirically distinct. This statistic is the most recent and appropriate for determining discriminant validity in the PLS-SEM context [22]. In terms of basic descriptors, for reasons of space, in Tables 2 and 3 the mean, mode, variance, kurtosis, and asymmetry are not reported. However, these were calculated beforehand, and only the correlations are shown.

Table 4. Validity and reliability of the measurement models (reflective).

Constructs	Loading	Cronbach's Alpha	Rho_A	Composite Reliability (pc)	Average Variance Extracted (AVE)
<i>Involvement culture</i>					
Ic-1	0.888	0.836	0.845	0.901	0.752
Ic-2	0.851				
Ic-3	0.863				
<i>Consistency culture</i>					
Cc-1	0.845	0.788	0.808	0.874	0.699
Cc-2	0.827				
Cc-3	0.836				
<i>Adaptability culture</i>					
Ac-1	0.787	0.728	0.745	0.845	0.646
Ac-2	0.764				
Ac-3	0.857				
<i>Mission culture</i>					
Mc-1	0.903	0.874	0.920	0.921	0.794
Mc-2	0.916				
Mc-3	0.853				
<i>Green Innovation</i>					
Gi-1	0.746	0.881	0.882	0.908	0.585
Gi-2	0.724				
Gi-3	0.828				
Gi-4	0.763				
Gi-5	0.776				
Gi-6	0.796				
Gi-7	0.710				
<i>Environmental performance</i>					
Ep-1	0.757	0.753	0.783	0.857	0.668
Ep-2	0.873				
Ep-3	0.817				

Table 5. Discriminant validity assessment (Fornell-Larcker criterion).

	Adaptability	Consistency	Environmental Performance	Green Innovation	Involvement	Mission
Adaptability	0.804					
Consistency	0.558	0.836				
Environmental Performance	0.626	0.707	0.817			
Green Innovation	0.655	0.751	0.744	0.765		
Involvement	0.629	0.677	0.672	0.726	0.867	
Mission	0.384	0.475	0.466	0.548	0.641	0.891

Table 6. Discriminant validity assessment (HTMT).

Adaptability	Adaptability	Consistency	Environmental Performance	Green Innovation	Involvement
Consistency	0.707				
Environmental Performance	0.822	0.890			
Green Innovation	0.810	0.877	0.894		
Involvement	0.796	0.814	0.835	0.840	
Mission	0.448	0.539	0.545	0.601	0.725

Table 7. Discriminant validity (HTMT). Confidence Interval Bias Corrected.

Constructs	Original Sample	2.5%	97.5%
Consistency→Adaptability	0.707	0.540	0.849
Env.Perf→ Adaptability	0.822	0.680	0.953
Env.Perf→ Consistency	0.900	0.790	0.999
Green.Innovation → Adaptability	0.810	0.691	0.912
Green.Innovation→ Consistency	0.877	0.782	0.957
Green.Innovation→ Env.Perf	0.894	0.791	0.985
Involvement→ Adaptability	0.796	0.682	0.903
Involvement→ Consistency	0.814	0.694	0.916
Involvement→ Env.Perf	0.835	0.716	0.940
Involvement→Green.Innovation	0.840	0.737	0.925
Mission→ Adaptability	0.448	0.299	0.595
Mission→ Consistency	0.539	0.382	0.687
Mission→ Env.Perf	0.545	0.380	0.693
Mission→Green.Innovation	0.601	0.460	0.723
Mission→ Involvement	0.725	0.618	0.817

With regard to the formative and composite models (Table 8), the variables or indicators measure the construct. In this case, it is assumed that the formative indicators either take complete control of the content of the construct or the indicators make up the entire composite. This is the reason for the difference when evaluating a reflective or formative model. Regarding the evaluation of the formative model of the second-order hierarchical construct, the model presents validity. According to Andreu et al. [54], the weights of the indicators must be higher than 0.1. Regarding the variance inflation factor (VIF), Diamantopoulos and Sigauw [55] consider maximum values of 3.3. In addition, all of them are statistically significant.

Table 8. Evaluation of the formative measurement.

Composite Formative (Second-Order Construct)	First-Order Construct	Weight	VIF	t-Values	p-Values
Culture Green	Involvement Culture	0.273	2.868	2.869 **	0.010
	Consistency Culture	0.504	1.961	7.730 ***	0.000
	Adaptability Culture	0.306	1.754	4.488 ***	0.000
	Mission Culture	0.142	1.713	2.405 **	0.000

Notes: *** Significant at 0.05 level based on 5000 bootstraps.

4.3. Structural Model

In order to evaluate the research model, a bootstrapping procedure was used, which allows one to test hypotheses statistically. The main evaluation criteria for evaluating the structural model are as follows: The importance of path coefficients and the levels of R^2 values. Standardized path values are between -1 and $+1$ whilst R^2 values of 0.75, 0.50, or 0.25 are interpreted as important, moderate, or weak [56,57].

Once it was confirmed that the reflective and formative measurement models were reliable and valid, the next step was to evaluate the structural model (Table 9). The structural model represents the

relationships among constructs or latent variables that are hypothesized in the research model and supported theoretically. The following was evaluated: The size and significance of path coefficients, the coefficients of determinations (R^2) of the endogenous constructs, and the direct and indirect effects. This is in accordance with some researchers who are often interested in evaluating not only the direct effect of one construct on another, but also their indirect effects through one or more mediating constructs [58]. In order to test the mediating effect, PLS-SEM was chosen due to its flexibility, given that it can be applied to composites and hierarchical and second-order models. This also includes mediator variables. In this specific case, green culture is a second-order composite and green innovation is the variable that mediates between the former and a company's environmental performance.

Table 9. Structural model.

Direct/Indirect Effect	Path Coefficient	95% BCCI	t-Value	p-Value	Supported
GC → EP	0.396 *	[0.048–0.742]	1.969	0.049	Yes (H1)
GC → GI	0.885 ***	[0.810–0.935]	28.368	0.000	Yes (H2)
GI → EP	0.547 **	[0.178–0.976]	2.671	0.008	Yes (H3)
GC → GI → EP	0.484 *	[0.161–0.903]	2.543	0.011	Yes (H4)

Notes: BCCI: bias corrected confidence intervals, (0.05,4999) = 1.645; t(0.01, 4999) = 2.327; t(0.001, 4999) = 3.092. * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

As can be seen in the Figure 2, the direct path coefficients have a significant effect ($\beta = 0.885$; $\beta = 0.547$; $\beta = 0.396$) and the explained variance ($R^2 = 0.781$; $R^2 = 0.838$) present loads and weights within the established thresholds. The results of direct effects give support to hypotheses H1, H2, and H3. In H1 it was discovered that the higher the level of green culture, the higher the level of environmental performance ($\beta = 0.396$). Likewise, with H2, the higher the level of green culture, the higher the level of green innovation ($\beta = 0.885$). The results of the investigation confirm that green culture is a current environmental ideology promoting sustainable economic and ecological development, based on science, politics and aesthetics [3]. In terms of H3, it was observed that the higher the level of green innovation, the higher the level of environmental performance ($\beta = 0.547$). This implies that green innovation is a determining factor for green performance. Therefore, green innovation implies improving administrative techniques and practices to help enhance environmental performance and give a competitive advantage [59]. Finally, H4 indicates that for green culture to enhance environmental performance further, green innovation is necessary given the fact that it acts as a complementary mediator variable (partial mediation). If green innovation can help companies to reduce or do away with environmental problems associated with production processes, it is because, according to resource- and capability-based theories, green innovation can be a valuable resource for an enterprise and may provide a competitive advantage [60,61].

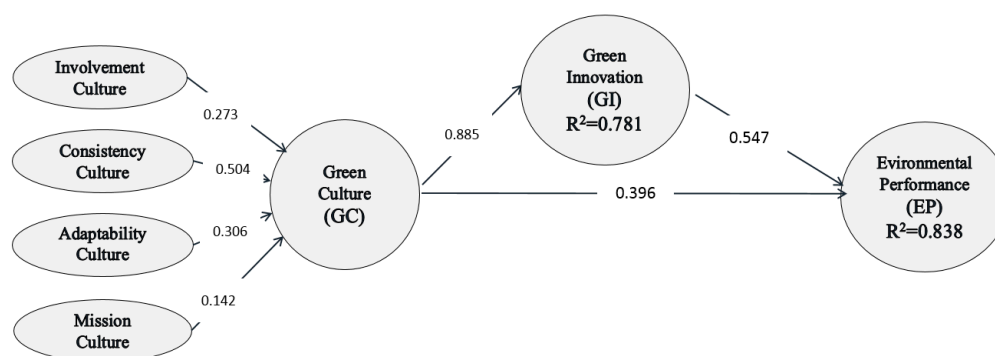


Figure 2. Structural model. Notes: (1): Green Culture is a Higher Order Construct (HOC). (2): Involvement Culture, Consistency Culture, Adaptability Culture, and Mission Culture, are Lower Order Constructs (LOC).

To evaluate the mediating effect, the criteria of Cepeda et al. [62] were considered in order to find the significance of the effects. In the first instance, it was observed that the direct effects are significant. Secondly, the indirect effect was also significant. These findings support hypothesis H4 (mediation). In this case, it was concluded that there is a partial or complementary mediating effect, which is given when both effects, direct and indirect, are significant and point in the same direction.

5. Conclusions and Discussion

The main objective of this study was to examine the mediating effect of green innovation on the relationship between green culture and environmental performance. The model was operationalized as a second-order or higher-order reflective-formative confirmatory model (HCM Type II). The results presented an $R^2 = 0.838$ for “Environmental performance” (EP). The decomposition of the variance between its two predictor constructs shows that 34.8% (0.396×0.880) is explained by the “green culture” (GC) second-order construct, and 49.0% (0.547×0.898) by the “green innovation” (GI) endogenous latent variable. This means that 83.8% of the “environmental performance” variance is explained by “green culture” and “green innovation.” Additionally, “green innovation” presents a $R^2 = 0.781$, which indicates that the proposed model has a substantial level of predictive power [50,63].

Furthermore, the model shows positive and statistically significant direct effects ($\beta = 0.885$; $\beta = 0.547$; $\beta = 0.396$). The greatest effect is found in green culture on green innovation. In addition, the study gives evidence of a significant indirect effect of 0.484, which corresponds to green innovation as a mediator variable on the relationship between green culture and environmental performance. These results are consistent with previous studies that provide empirical evidence to show that green culture has an impact on performance and innovation and that the innovation of ecological products and processes has positive effects on environmental performance and organizational performance. Thus, the innovation of green products also mediates the relationship between corporate environmental ethics and corporate advantage, as other previous research has shown [34,38,64].

The results obtained in this research complement those of Yang et al. [8] in a study involving 300 Chinese organizations which confirm that green culture and green innovation have a positive impact on performance. The same is true of a study by Kassar et al. [65] on the impact of green innovation and environmental performance in the Middle East and North Africa, where a direct, positive, and significant impact was observed with green products and environmental performance. Therefore, companies need to unify resources and capabilities in order to promote green innovation. Additionally, all countries must rise to the environmental challenge in order to promote green culture in the worldwide marketplace. Processes and services need to be innovated for the good of environmental performance. All this works for the benefit of the environment and society. Promoting this sort of ecological practices means reducing energy consumption and harmful emissions, treating pollutant waste and providing a sustainable environment to protect the environment and human health.

In conclusion, in order for companies to reach a good level of environmental performance, strategies that go beyond a mere adherence to government regulations are required. These strategies should promote and drive green culture into the collective consciousness. Going green will, undoubtedly, help to diminish environmental problems within organizations. Additionally, the scientific merit of the study is found in its confirmation of the role of green innovation as mediating construct. Therefore, the findings herein can be considered as complementary to the existing body of knowledge in the field.

5.1. Theoretical Contribution

Based on resource-based theory and, specifically, on the view of a company involved in using natural resources [12], this study empirically proved that in the automotive industry of the State of Mexico a research model of environmental practices is useful for environmental care. The findings provide important theoretical contributions to the literature: (1) Green culture is seen as a predictor of environmental performance and green innovation, and (2) the research demonstrates the mediating effect of green innovation on the relationship between green culture and environmental performance.

Based on the pre-existing literature regarding the positive impact organizational culture has on employee productivity and viewing green innovation as a mediating construct [8,37], this research reinforces these findings and paves the way for the automotive industry to promote green culture within their organizations. This should not be seen merely as an environmental practice designed to comply with established government laws and codes of practice, rather, as an organizational culture in which employees are committed to protecting their health and the world around them. It ought not to be forgotten that internal company policies are not solely focused on a commitment to the environment. Rather, these go hand in hand with organizational performance which can ultimately lead to growth in an increasingly competitive marketplace. The results of this study have been proved empirically and they coincide with previous research. They complement the existing, yet limited, body of knowledge on green culture, environmental performance, and green innovation. It is for this reason that our empirical findings are considered to be relevant and they represent a scientific contribution to the field.

5.2. Management Implications

Economic growth and the protection of the environment, from the perspective of sustainable development, is a task that should interest industry in general. In view of this, managers and executives of the automotive industry ought to promote a green culture that is based on innovation and good environmental performance. It is most likely that an organization, in which green culture is encouraged, as part of its values and proposals, can generate a commitment to environmental care. This is beneficial to society and especially human health. For this, it is necessary to take actions and adopt preventative strategies in order to promote green culture within organizations. In this way, employees will become more aware of the fact that if they care for the environment, we will leave a better planet for future generations.

5.3. Limitations and Future Research

This research has some limitations. First of all, a cross-sectional study was done, which means that the data was collected in a single period of time. Secondly, it is important to broaden the sample size and replicate the study in other industrial sectors and states in the country (even in other countries) in order to have more solid results. Despite this, our study and its results present a foundation and a basis for future research to be done in Mexico and in other emerging economies. In addition, these findings ought to be interpreted given that they may be generalized to other contexts. It is important that these types of organizational variables be applied to longitudinal study designs, allowing for long-term comparisons of the results.

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Appendix A

Green Culture

Involvement culture (1 = completely disagree and 5 = completely agree)

- The company promotes environmental care and sustainable development.
- At this company people take decisions to protect the environment and sustainable development.
- This company trains its staff about environmental care and sustainable development in order to promote green living.

Consistency culture (1 = completely disagree and 5 = completely agree)

- The company has a culture of consciousness and a set of values that play a role in how people act in terms of environmental care and sustainable development.
- The company takes established environmental policy into account when conducting business.
- Our leaders and employees are conscious of human development based on values of environmental and sustainable development.

Adaptability culture (1 = completely disagree and 5 = completely agree)

- Our organization is prepared to adapt to changes for the sake the environment and sustainable development.
- Our organization constantly adapts to new information in order to improve in accordance with environmental policies.
- Our organization listens to customers' opinions and these can lead to organizational changes.

Mission culture (1 = completely disagree and 5 = completely agree)

- Our organization has a clear mission and this includes environmental protection and sustainable development.
- Our organization looks to the future and is aware of the consequences of not caring for the environment.
- In our institution we have a clear idea of what caring for the environment and sustainable development entails for long-term success.

Green Innovation (1 = completely disagree and 5 = completely agree)

- At our company we use less polluting or less toxic materials in order to care for the environment.
- At our company we use recycled material to care for the environment.
- At our company we are innovative in creating green products.
- At our company we reduce harmful emissions and dangerous waste in manufacturing processes.
- At our company we use clean and renewable energy.
- At our company we promote a culture of green technology.
- At our company we have strategies to work towards a green way of living as part of our environmental initiative.

Environmental Performance (1 = completely disagree and 5 = completely agree)

- At our company production and operation processes have been redesigned with environmental protection in mind.
- Our company has established objectives related to environmental care for the reduction of dangerous waste and harmful emissions.
- Our company respects environmental policies in order to counteract harmful emissions from processes.

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