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Evaluation of the impact of GSCM on the overall performance of Moroccan companies through Structural Equation Modeling

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Abstract:

This study aims to explore the impact of Green Supply Chain Management (GSCM) practices on the overall performance of Moroccan industrial companies. Specifically, it seeks to understand how both internal and external environmental practices influence organizational competitiveness and overall performance. The research investigates whether integrating sustainable practices within company operations and across supply chain relationships enhances organizational outcomes.
The study employs Structural Equation Modeling (SEM) to test the proposed hypotheses. Data collection was conducted through survey questionnaires distributed to Moroccan industrial companies, utilizing a 5-point Likert scale to measure the observed variables. The sample responses were analyzed to determine the relationships between various GSCM practices (both internal and external) and the overall performance of the companies.
Three main findings emerge from this research. First, internal environmental management practices, such as waste reduction, eco-design, and energy efficiency, significantly improve overall company performance. Second, external environmental practices, particularly those concerning supplier and customer relationships (e.g., green purchasing and cooperation with customers), do not show a statistically significant impact on performance in the Moroccan context. Third, the integration of internal GSCM practices is identified as a crucial factor in driving sustainable competitiveness within Moroccan industrial firms, highlighting the importance of internal operations in fostering long-term business success.
This research is one of the first empirical studies to evaluate the role of GSCM practices within Moroccan industrial companies. It contributes to the growing body of knowledge by emphasizing the strategic importance of internal environmental practices and offering valuable insights for companies looking to improve their external GSCM strategies. The findings are relevant for both academics and practitioners aiming to refine sustainability practices within supply chains and enhance organizational performance in emerging markets.

Keywords : Green Supply Chain Management, Organizational performance, Environmental practices, Structural Equation Modeling, Moroccan industrial companies.
Classification JEL :M11, M14 ,C52
Paper type : Empirical Research

Résumé

Cette étude vise à explorer l’impact des pratiques de gestion de la chaîne d'approvisionnement verte (Green Supply Chain Management GSCM) sur la performance globale des entreprises industrielles marocaines. Plus précisément, elle cherche à comprendre comment les pratiques environnementales internes et externes influencent la compétitivité organisationnelle et la performance globale. La recherche examine si l'intégration de pratiques durables dans les opérations des entreprises relative à la chaîne d'approvisionnement améliore les résultats organisationnels.
L’étude utilise la modélisation par équations structurelles (Structural Equation Modeling - SEM) pour tester les hypothèses proposées. La collecte des données a été réalisée à l'aide de questionnaires distribués aux entreprises industrielles marocaines, en utilisant une échelle de Likert à 5 points pour mesurer les variables observées. Les réponses de l’échantillon ont été analysées afin de déterminer les relations entre les différentes pratiques de GSCM (internes et externes) et la performance globale des entreprises.
Trois principaux résultats émergents de cette recherche. Premièrement, les pratiques de gestion environnementale interne, telles que la réduction des déchets, l’éco-conception et l’efficacité énergétique, améliorent significativement la performance globale des entreprises. Deuxièmement, les pratiques environnementales externes, en particulier celles concernant les relations avec les fournisseurs et les clients (par exemple, les achats verts et la coopération avec les clients), ne montrent pas d’impact statistiquement significatif sur la performance dans le contexte marocain. Troisièmement, l’intégration des pratiques internes de GSCM est identifiée comme un facteur crucial pour stimuler la compétitivité durable au sein des entreprises industrielles marocaines, soulignant l’importance des opérations internes dans la promotion du succès à long terme des entreprises.
Cette recherche est l'une des premières études empiriques à évaluer le rôle des pratiques de GSCM au sein des entreprises industrielles marocaines. Elle contribue à l’enrichissement des connaissances en mettant l'accent sur l'importance stratégique des pratiques environnementales internes et en offrant des perspectives précieuses pour les entreprises cherchant à améliorer leurs stratégies externes de GSCM. Les résultats sont pertinents à la fois pour les universitaires et les praticiens souhaitant affiner les pratiques de durabilité au sein des chaînes d'approvisionnement et améliorer la performance organisationnelle dans les marchés émergents.

Mots-clés : Gestion de la chaîne d’approvisionnement verte, Performance organisationnelle, Pratiques environnementales, Modélisation par équations structurelles, Entreprises industrielles marocaines.
Classification JEL : M11, M14, C52
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1. Introduction

In recent years, heightened consumer awareness of environmental issues and the growing public concern over ecological problems have driven companies to integrate environmental considerations into their manufacturing processes and supply chains (Giannis et al., 2006). This integration has led to the emergence of **Green Supply Chain Management (GSCM)**, a paradigm that focuses on the coordination of logistics processes among various partners while considering ecological imperatives. GSCM ensures the effectiveness of public policies as well as the environmental strategies adopted by companies. Moreover, GSCM contributes to enhanced profitability, market share growth, and improves a company's reputation and brand image (Herrmann et al., 2021).

The adoption of GSCM by companies can be attributed to several factors. Legally binding environmental regulations are one major reason pushing businesses to adopt greener practices. However, some companies view GSCM as a strategic tool for differentiation, helping them to stand out from competitors and meet the growing ecological demands of consumers. Additionally, market competition often encourages firms to align with the strategic practices of their rivals, particularly when direct competitors implement GSCM. In this context, it becomes essential for other companies to adopt similar approaches to avoid being perceived as lagging behind in environmental responsibility (Dube & Gawande, 2011).

Socially responsible companies are increasingly aware of the environmental impact of their industrial and logistical operations, such as air pollution, noise pollution, biodiversity loss, greenhouse gas emissions, and the depletion of fossil fuels (OUFKIRI & ZARI, 2022). Like all economic actors, they are committed to ensuring sustainable development. In this pursuit, companies play a significant role by implementing environmental management systems and adopting social responsibility practices (Éric & Luyindula, 2015). Corporate social responsibility (CSR) is considered a strategic approach that guides company actions towards social and environmental objectives, ensuring not only societal welfare but also the efficiency, effectiveness, and legitimacy of the firm (Martinet & Reynaud, 2004).

Furthermore, a sustainable supply chain emphasizes the three pillars of sustainable development: economic, social, and environmental. The increasing focus on the **three Ps** (People, Profit, Planet) can be attributed to several factors: rising energy resource costs, national and international regulatory pressures, and growing consumer awareness of the environmental impact of consumption choices (OUFKIRI & ZARI, 2022).

By considering the three Ps in their industrial and commercial activities, companies continuously strive for **global performance**, aiming to enhance both efficiency and effectiveness across all aspects of their financial and non-financial operations. This pursuit of greater efficiency is based primarily on their ability to achieve economic and financial objectives while meeting the needs and expectations of their stakeholders, incorporating social and environmental responsibility into all their activities. This raises the central question of how the environmental commitment of Moroccan companies impacts their overall performance.

Furthermore, Global environmental challenges and stringent regulations have driven companies to adopt sustainable practices in their operations. Green Supply Chain Management (GSCM) has emerged as a strategic approach to integrate environmental considerations into supply chain operations. While significant research has examined GSCM in developed economies, limited studies focus on emerging markets such as Morocco.

This study aims to bridge this gap by investigating the impact of GSCM practices on the performance of Moroccan industrial firms. Specifically, we employ the model of Zhu et al. (2008) to analyze the influence of internal and external environmental practices on two dimensions of performance. Two research questions guide this study:

Do internal GSCM practices positively affect the performance of Moroccan industrial companies?
Do external GSCM practices positively affect the performance of Moroccan industrial companies?

Given these observations, this study seeks to address this gap in the literature by investigating the relationship between environmental engagement and organizational performance in Moroccan industries. To do so, the study will be divided into two parts. The first part will provide a comprehensive definition of GSCM and explore the conceptual frameworks that support it, based on a review of international literature. The second part will assess the proposed conceptual model through **structural equation modeling (SEM)**, offering an empirical evaluation of the hypothesized relationships.

2. Literature Review

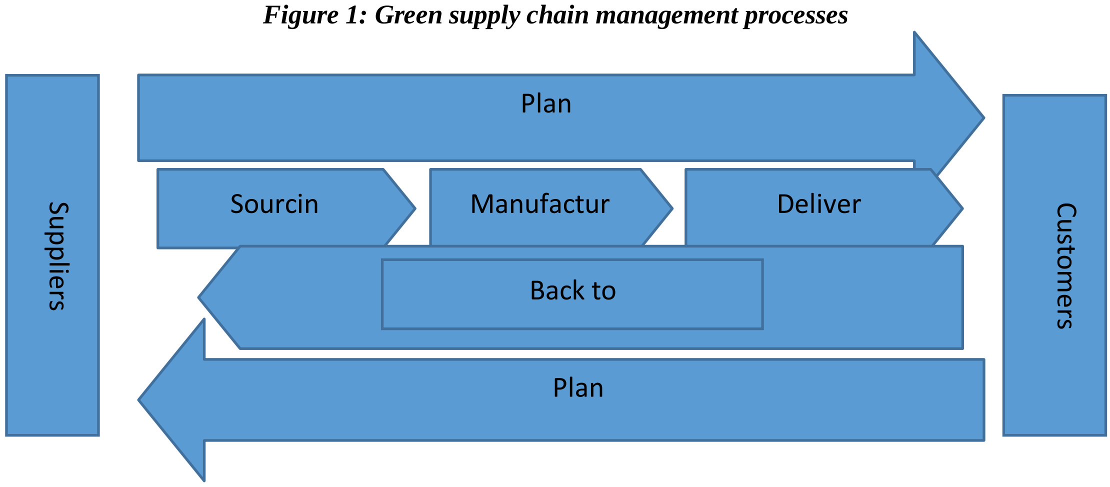
2.1. Green Supply Chain Management (GSCM)

Green Supply Chain Management (GSCM) encompasses a set of interrelated processes designed to deliver environmentally friendly products to customers while enabling the potential return of these products after their use by the end consumer. These processes integrate multiple companies into a network structure, necessitating effective coordination across various supply chain links. As outlined by Stadler (2002), GSCM involves two essential activities: network integration and coordination among supply chain participants.

Integration encompasses partner selection, collaboration, network governance, and organizational structuring. On the other hand, coordination involves network planning and control, as well as the synchronization of information through data sharing and exchange. Cooper and Lambert (2000) propose that these integration and coordination processes can be structured around the following axes: supplier relationship management, customer relationship management, product development and commercialization, demand management, customer service management, order management, production flow management, and reverse logistics. Each of these axes incorporates environmental considerations within GSCM.

To further simplify these processes, the Supply Chain Operations Reference (SCOR) model, developed by the Supply Chain Council (SCC), categorizes them into five main activities: planning, sourcing, manufacturing, delivery, and reverse logistics. Figure 1 illustrates the SCOR model, highlighting its integration into GSCM practices.

Figure 1: Green supply chain management processes



Source:(SCC, 2006)

- ***Planning***

According to Ackoff, planning involves "designing a desired future and identifying the means to achieve it." In the context of GSCM, planning entails configuring the logistics network and

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designing environmentally friendly products. The environmental performance of GSCM heavily depends on effective planning (Paquet, 2005). An integrated logistics network minimizes the environmental footprint by aligning all participants with shared ecological concerns, thereby fostering environmentally responsible behaviors (El Bounjimi Mbarek, 2016).

Eco-design plays a critical role in reducing the environmental impacts of products throughout their life cycle, encompassing transportation, packaging, storage, and reverse logistics. Research indicates that eco-design can minimize up to 80% of a product's ecological impact (Buyukozan & Cifci, 2012). Kumar and Puntam (2008) emphasize that eco-design is essential for achieving environmental performance and for enabling effective product recovery at the end of its life cycle.

- ***Green Sourcing***

Green sourcing, like planning, is a critical process within GSCM. Its significance lies in its position upstream of manufacturing, allowing companies to reduce environmental impacts by selecting environmentally conscious suppliers. Traditional economic criteria for supplier selection (e.g., quality, delivery, and cost) are supplemented with environmental criteria, including ISO 14001 certification, the presence of an environmental management system (EMS), recyclable raw materials, reduced packaging, and reusable components (Hamner, 2006).

- ***Green Manufacturing***

Green manufacturing is an intrinsic process within GSCM, involving the transformation of inputs (e.g., raw materials, components, energy) into outputs (e.g., intermediate and finished products). These processes must adhere to environmental standards regarding energy, technology, and materials (Dornfeld, 2010). Companies increasingly adopt eco-friendly technologies and equipment to reduce raw material and energy consumption while minimizing carbon footprints (Deif, 2011).

- ***Green Distribution***

Distribution, as part of the marketing mix (the four Ps: price, product, promotion, and place), involves delivering products to customers. This process includes two sub-processes: green warehousing and green transportation.

Green warehousing involves managing storage facilities in an environmentally friendly manner, incorporating eco-construction practices such as using non-toxic materials and renewable energy sources like solar and wind power.

Green transportation seeks to minimize the environmental impact of transport by employing newer, less polluting vehicles (e.g., electric or hybrid) and exploring alternative, more sustainable transport modes such as waterways, railways, or optimized road logistics. Pan et al. (2011) advocate for shared transport resources among supply chains to reduce CO2 emissions and optimize vehicle utilization.

- ***Reverse Logistics***

Reverse logistics pertains to operations aimed at reusing products or materials, including the management of return flows from end consumers to companies. These operations encompass collection, sorting, disposal, and redistribution (Fleischmann, 2001). Reverse logistics minimizes the environmental footprint of the supply chain, closing the loop within the GSCM framework as illustrated in the SCOR model (SCC, 2006).

2.2. Conceptual Models of GSCM

After exploring the pillars and processes of GSCM, this section highlights key theoretical frameworks that conceptualize GSCM, tracing its development as a paradigm in management sciences.

GSCM is both a philosophy and an integrated management tool designed for the efficient operation of industrial enterprises adopting proactive approaches to environmental turbulence (Zhu and Sarkis, 2007). Its scope includes a wide range of practices, from green sourcing to reverse logistics, encompassing eco-design, green manufacturing, and green distribution. As Zhu and Sarkis (2007) noted :

"GSCM has emerged as an effective management tool and philosophy for proactive and leading manufacturing organizations. The scope of GSCM practices implementation ranges from green purchasing to integrated lifecycle management supply chains flowing from supplier, through to manufacturer, customer, and closing the loop with reverse logistics."

Theoretically, research has often focused on one or several aspects of GSCM. Table 1 below summarizes key conceptual frameworks addressing GSCM:

Table 1: Conceptual Frameworks of GSCM

Year and Authors	Conceptual Framework	Aspect of GSCM
Carter et al. (1998)	Ecological purchasing model benchmarking American and German managers	Green sourcing supported by top management, middle management, organizational mission, and employee training in environmental aspects
Walton et al. (1998)	Conceptual model for supplier environmental assessment	ISO 14001 certification, assessment of second-tier suppliers' environmental practices
Handfield et al. (2002)	Decision model using multi-attribute theory for environmental impact measurement	Environmental practices of suppliers
Faruk et al. (2002)	Model evaluating GSCM implementation across product lifecycles	Materials acquisition, production, usage, distribution, waste disposal
Sarkis (2003)	Strategic decision model for implementing GSCM practices	Supplier and customer relationships
Zhu and Sarkis (2004; 2005)	Conceptual model of GSCM practices and performance in Chinese enterprises	Internal environmental management, green sourcing, customer cooperation, eco-design, and investment recovery
Sheu et al. (2005)	Multi-objective linear programming model optimizing logistics operations	Supplier and customer relationships
Kainuma and Tawara (2006)	Evaluation model for GSCM across product/service lifecycles	Recycling and reuse
Srivastava (2007)	Conceptual model of GSCM implementation focusing on eco-design and green operations	Lifecycle analysis (LCA), eco-friendly design, pollution prevention, and waste reduction
Seuring and Müller (2008)	Sustainable SCM framework including environmental, social, and economic dimensions	Environmental pressures, incentives, barriers, green supplier and product management, lifecycle analysis, waste reduction
Zhu, Sarkis, Cordeiro, and Lai (2008)	Conceptual model for GSCM implementation	Internal environmental management, green sourcing, customer cooperation, eco-design, investment recovery
Testa and Iraldo (2010)	Model analyzing the impact of GSCM practices on environmental and organizational performance	Institutional mechanisms (normative, coercive, mimetic), internal motivators (reputation, LCA, green logistics, innovation)
Azevedo, Carvalho, and Cruz Machado (2011)	Framework analyzing the impact of environmental practices on supply chain performance	Green sourcing, collaboration in eco-design, waste reduction, ISO 14001 certification, reverse logistics
Sellitto (2018)	Model evaluating GSCM implementation based on strategy, innovation, and operations	Strategic: green strategy formulation, performance control, partner cooperation; Innovation: green processes and products; Operations: green sourcing, manufacturing, distribution, reverse logistics

Source: Authors

Based on the table, it is evident that several theoretical works have approached the field of Green Supply Chain Management (GSCM) from various perspectives over the past two decades, analyzing the impact of its practices on performance across different dimensions: environmental, social, operational, economic, and financial. For the purposes of this article, we have selected the model proposed by Zhu, Sarkis, Cordeiro, and Lai (2008). This model has the advantage of categorizing GSCM environmental practices into two distinct blocks: The internal block: This refers to all operations carried out within the company aimed at addressing the environmental dimension, specifically through internal environmental management. The external block: This refers to the extension of environmental practices beyond the company's boundaries, particularly in relationships with suppliers (e.g., green purchasing and eco-design) and customers (e.g., eco-design), which is described as GSCM.

2.3 Empirical Review and Hypothesis Development

Numerous empirical studies have investigated the impact of Green Supply Chain Management (GSCM) practices on various dimensions of performance. For instance, research conducted in different countries, including Jabbour et al. (2016) in Brazil, Zhu and Sarkis (2004) and Lai and Wong (2012) in China, Hajmohammad et al. (2013) in Canada, and Lee (2013) in South Korea, has demonstrated a positive correlation between GSCM practices and environmental performance. Table 2 below provides an overview of some of these studies.

Table 2: the impact of Green Supply Chain Management (GSCM) practices on various dimensions of performance

Year and Authors	Variables	Type of Relationship
Green et al. (2012), Jabbour et al. (2016)	GSCM and operational performance	GSCM leads to improved operational performance.
Zhu and Sarkis (2004), Lai and Wong (2012), Hajmohammad et al. (2013), Lee (2013)	GSCM and environmental performance	GSCM leads to improved environmental performance.
Zhu et al. (2010), Vinodh et al. (2011), Green et al. (2012), Zailani et al. (2012), Fang and Zhang (2018), Luthra et al. (2014), KRHL Gunasekara et al. (2023)	GSCM and overall performance	GSCM leads to overall performance improvement.
Jayarathna and Lasantha (2018)	GSCM and financial performance	GSCM leads to improved financial performance of companies.
	GSCM and social performance	GSCM leads to improved social performance of companies.

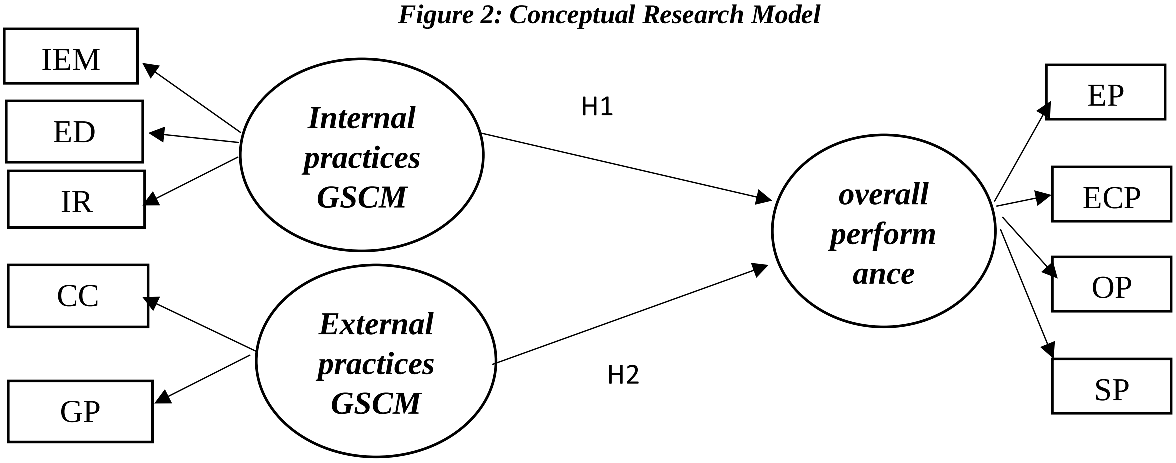
Source: Authors

These studies collectively provide evidence that GSCM practices positively influence operational, environmental, financial, and social performance dimensions, underscoring their global relevance.

The operationalization of Green Supply Chain Management (GSCM) across five dimensions: Internal Environmental Management (IEM), Green Purchasing (GP), Cooperation with Customers (CC), Eco-Design (ED), and Investment Recovery (IR) will enable the formulation of our research problem into two key hypotheses:

- ✓ ***Internal practices exert a positive impact on overall performance (H1).***
- ✓ ***External practices exert a positive effect on overall performance (H2).***

Figure 2: Conceptual Research Model



Source: Authors

3. Methodology

3.1. The scale of research concepts

The measurement scales utilized in this study are derived from the work of Zhu, Sarkis, and Lai (2008). These authors identified 21 items organized across five key dimensions of Green Supply Chain Management (GSCM). These dimensions were empirically tested on a sample of 341 industrial companies in China, ensuring their reliability and validity. The five dimensions are as follows: Internal Environmental Management (IEM): Focuses on the implementation of environmental practices within the organization, including policy, training, and cross-departmental collaboration. Green Purchasing (GP): Measures the extent to which companies integrate environmental considerations into their procurement processes. Customer Cooperation for Environmental Management (CCEM): Assesses collaborative efforts with customers to achieve environmental objectives, such as reducing waste and increasing eco-efficiency. Investment Recovery (IR): Evaluates practices related to the recovery, reuse, and recycling of resources and materials. Eco-Design (ED): Captures the degree to which environmental concerns are incorporated into product design, such as reducing resource usage or improving recyclability.

Overall performance is conceptualized as the aggregation of economic, social, and environmental dimensions, aligning with the triple bottom line framework (Baret, 2006). To ensure a comprehensive assessment, this study operationalizes overall performance through five distinct dimensions: Environmental Performance (EP): Refers to the organization's ability to mitigate its environmental impact, encompassing initiatives such as waste reduction, energy conservation, and pollution control. Economic Performance (ECP): Evaluates the financial benefits derived from sustainable practices, including cost savings, profitability, and enhanced return on investment. Operational Performance (OP): Measures improvements in internal processes, with a focus on efficiency, productivity, and effective resource utilization. Social Performance (SP): Examines the organization's contributions to societal well-being, addressing aspects such as employee welfare, community engagement, and adherence to ethical standards. Financial Performance (FP): Captures traditional financial outcomes, such as revenue growth, net income, and shareholder value, as influenced by sustainability-oriented initiatives.

3.2. Research design

This study adopts a quantitative approach, employing Structural Equation Modeling (SEM) to test the proposed hypotheses. A structured questionnaire was distributed to 300 Moroccan industrial companies in the aeronautics, automotive, agri-food, and textiles sectors. A total of 126 valid responses were received, yielding a response rate of 42%.

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The Smart PLS 4.0 software will be utilized to evaluate our model by computing the indices required to assess reliability, validity, and hypothesis testing. This software was selected due to its numerous advantages in structural equation modeling (SEM), including its user-friendly interface, intuitive functionality, and ability to present results through clear and concise summary reports (Temme et al., 2006).

4. Results

Before analyzing our conceptual model, it is essential to determine the nature of the variables constituting the model. This step is critical as it guides the evaluation process by identifying the appropriate validation criteria (formative or reflective variables). Once the nature of the variables is established, the analysis will proceed in two stages. First, we will assess the measurement model by evaluating its reliability, convergent validity, and discriminant validity. Second, we will assess the structural model by examining its predictive relevance, goodness of fit, and the testing of the underlying hypotheses.
Given that our model comprises second-order constructs, we will adopt the two-stage approach. This method offers superior results in estimating the relationships between exogenous and endogenous variables compared to the repeated indicators approach. As noted by Hair et al. (2019), "In contrast, the two-stage approach shows a better parameter recovery of paths pointing (1) from exogenous constructs to the higher-order construct, and (2) from the higher-order construct to an endogenous construct in the path model."
The two-stage approach will involve two key steps. In the first step, direct relationships will be established between the first-order constructs and their endogenous variables, followed by computation using the PLS-SEM algorithm. This step will allow for the assessment of the reliability and validity of the measurement models, independent of the second-order constructs. In the second step, the second-order constructs will be estimated based on the latent variable scores obtained from the previous step. Finally, the structural model will be evaluated by testing the significance of the relationships between the second-order constructs and the endogenous variables.

4.1. Type of variable

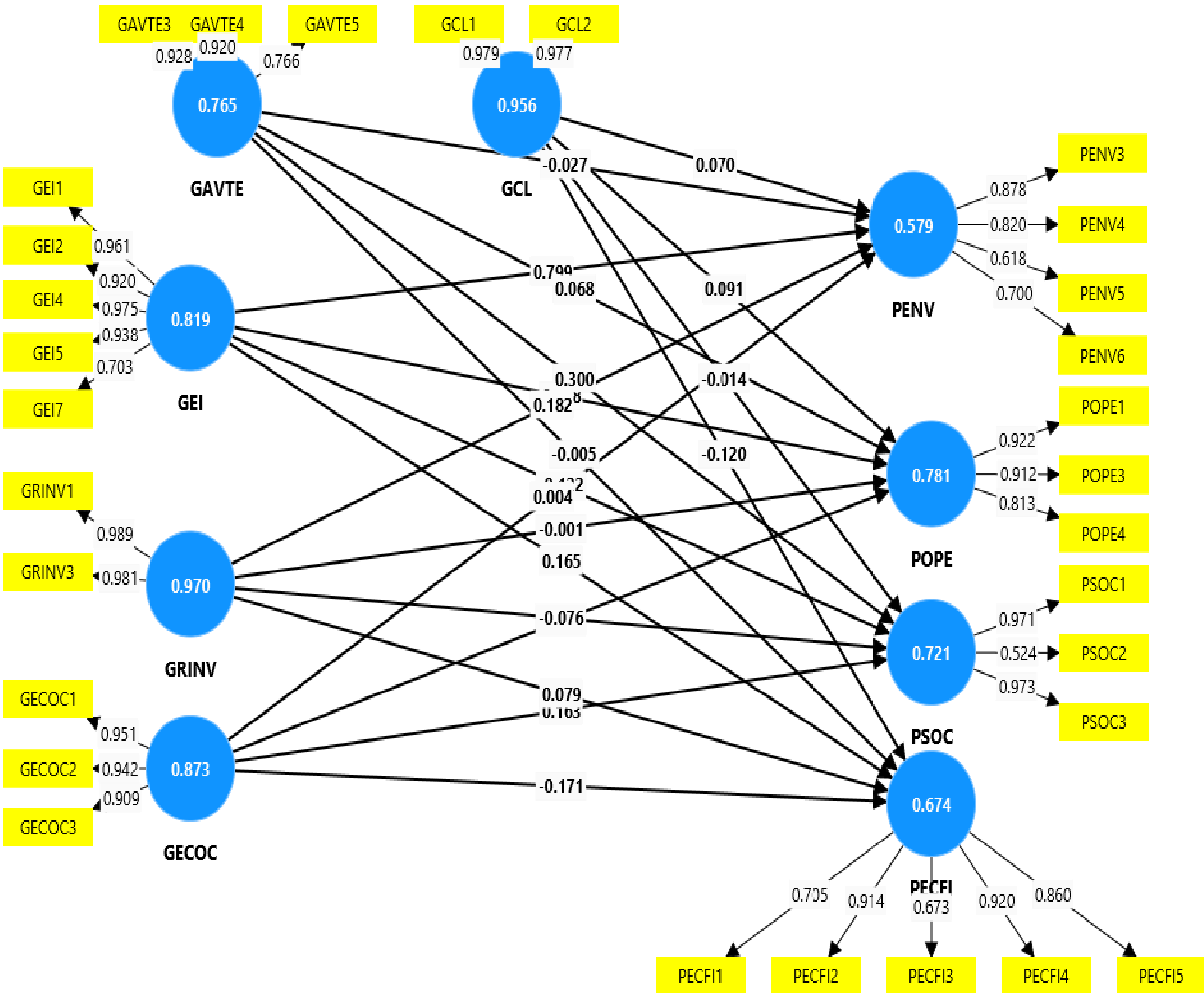
The criteria outlined by Jarvis et al. (2004) provide a framework for distinguishing between reflective and formative variables based on several key factors. These include the direction of causality between indicators and constructs, the interchangeability of items, the covariance among indicators, and their alignment within nomological networks.
Applying these criteria, the variables in our conceptual model are identified as reflective. This is evidenced by the high correlations among the indicators, as demonstrated by the correlation coefficients obtained through the descriptive analysis conducted using SPSS software. Moreover, the indicators are substitutable, and their removal does not compromise the construct’s internal coherence. The theoretical foundations underpinning this study further support the reflective nature of these variables, and factorial analysis confirms that the measurement scales exhibit a unidimensional factorial structure.

4.2. Testing the measurement model:

Our conceptual model comprises nine first-order constructs: four constructs represent the dependent variable, global performance (operational performance, environmental performance, social performance, and economic and financial performance), while five constructs represent the independent variable, green management (green purchasing, cooperation with customers, internal environmental management, investment payback, and eco-design).

Figure 3 illustrates the relationships between the various latent variables in the model, along with the factorial contributions of the items used to construct these variables. This visualization corresponds to the initial stage of the two-stage approach.
Initially, we will evaluate the measurement scales employed for the exogenous variable, "Green Management," by analyzing their reliability as well as their convergent and discriminant validity. Subsequently, we will conduct a similar assessment for the measurement scales used for the endogenous variable, "Overall Performance," by calculating the corresponding reliability and validity indices.

Figure 2: Two-Stage Measurement Models.



Source: Smart PLS 4.0

4.2.1 Evaluation of first-order measurement models for the Green Management variable.

Table 2: Indicators of the reliability of models for measuring GM first-order constructs

	Cronbach's alpha	Composite reliability (rho_c)	Average variance extracted (AVE)
GAVTE	0,858	0,906	0,765
GCL	0,954	0,978	0,956
GECOC	0,928	0,954	0,873
GEI	0,941	0,957	0,819
GRINV	0,969	0,985	0,970

Source: Smart PLS report

As previously mentioned, Green Management (GM) is conceptualized as a second-order construct composed of five first-order dimensions: Green Purchasing (GAVTE), Cooperation

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with Customers (GCL), Internal Environmental Management (GEI), Investment Payback (GRINV), and Ecodesign (GECOC).

An examination of the results presented in this table reveals that all composite reliability and Cronbach's Alpha values for the first-order GM constructs exceed the recommended threshold of 0.7 (Hair et al., 2011; Nunnally and Bernstein, 1994; Tenenhaus et al., 2005). This demonstrates the internal consistency of the measurement models (Fornell and Larcker, 1981), thereby confirming their reliability.

Table 3: Convergent validity of GM first-order construct measurement models

	Items	Weight	AVE
Buy green	***GAVTE3***	**0,928**	
(GAVTE)	***GAVTE4***	**0,920**	**0,765**
	GAVTE5	**0,766**	
Cooperation with customers	***GCL1***	**0,979**	**0,956**
(GCL)	***GCL2***	**0,977**	
Ecodesign	***GECOC1***	**0,951**	
(GECOC)	***GECOC2***	**0,942**	**0,873**
	GECOC3	**0,909**	
Management	***GEI1***	**0,961**	
Environmental	***GEI2***	**0,920**	
Internal	***GEI4***	**0,975**	**0,819**
(GEI)	***GEI5***	**0,938**	
	GEI7	**0,703**	
Investment recovery	***GRINV1***	**0,989**	**0,970**
(GRINV)	***GRINV3***	**0,981**	

Source: Smart PLS report

All indicators exhibit weights exceeding the 0.7 threshold, which is necessary to establish convergent validity (Nunnally, 1978; Nunnally and Bernstein, 1994; Tenenhaus et al., 2005). Additionally, the average variance extracted (AVE) for all constructs surpasses 70%, well above the required threshold of 50%. This indicates that the five latent variables account for over 70% of the variance in their respective indicators, thereby confirming the validity of these measurement constructs.

Table 4: Cross loadings of GM first-order variables :

	GAVTE	GCL	GECOC	GEI	GRINV
GAVTE3	0,928	0,164	0,082	0,043	**-0,040**
GAVTE4	0,920	0,076	0,080	0,006	**0,086**
GAVTE5	0,766	0,112	0,091	0,001	**-0,065**
GCL1	0,119	0,979	0,107	0,094	**-0,100**
GCL2	0,150	0,977	0,070	0,045	**-0,065**
GECOC1	0,051	0,095	0,951	0,873	**-0,043**
GECOC2	0,052	0,136	0,942	0,732	**-0,070**
GECOC3	0,171	0,015	0,909	0,690	**-0,030**
GEI1	-0,033	0,063	0,826	0,961	**0,004**
GEI2	-0,041	0,049	0,697	0,920	**-0,040**
GEI4	-0,041	0,049	0,783	0,975	**0,022**
GEI5	-0,064	0,095	0,790	0,938	**-0,011**
GEI7	0,378	0,074	0,631	0,703	**-0,034**
GRINV1	0,025	-0,071	-0,060	0,002	**0,989**
GRINV3	**-0,026**	**-0,100**	**-0,039**	**-0,027**	**0,981**

Source: Smart PLS report

Table 4 demonstrates that the contributions of the items to their respective latent variables are higher than their contributions to other latent variables. This indicates a strong correlation between the indicators and the latent variables they are intended to measure (Chin, 1998;

Lacroux, 2011). Additionally, the Fornell-Larcker criterion is applied to ensure that the variance shared between a latent variable and its indicators is greater than the variance shared between that latent variable and other latent variables. Statistically, this requires that the square root of the average variance extracted (AVE) of a latent variable exceeds its correlation with any other latent variable (Sosik et al., 2009). Table 5 provides a detailed illustration of this index.

Table 5: Fornell-Larcker criterion

	GAVTE	GCL	GECOC	GEI	GRINV
GAVTE	**0,875**				
GCL	**0,137**	**0,978**			
GECOC	**0,092**	**0,091**	**0,934**		
GEI	**0,025**	**0,072**	**0,827**	**0,905**	
GRINV	0,002	-0,085	-0,051	-0,011	0,985

Source: Smart PLS report

All latent variables exhibit a substantial proportion of shared variance with their respective indicators, exceeding the variance shared with other constructs. This confirms that the second criterion for convergent validity is satisfied.

The third indicator of convergent validity is the Heterotrait-Monotrait ratio of correlations (HTMT), which assesses the degree of multicollinearity between the indicators of latent variables. Developed by Henseler et al. (2015) to address the limitations of previous indices, the HTMT measures the correlation between two latent variables. For validity, this value should be below 0.85 (Kline, 2015) or, according to some researchers, below 0.90 (Gold et al., 2001; Teo et al., 2008; Henseler et al., 2015).

Table 6: Heterotrait-monotrait ratio (HTMT)

	Heterotrait-monotrait ratio (HTMT)
GCL <-> GAVTE	**0,147**
GECOC <-> GAVTE	**0,114**
GECOC <-> GCL	**0,093**
GEI <-> GAVTE	**0,145**
GEI <-> GCL	**0,077**
GEI <-> GECOC	**0,878**
GRINV <-> GAVTE	**0,080**
GRINV <-> GCL	**0,090**
GRINV <-> GECOC	**0,052**
GRINV <-> GEI	**0,030**

Source: Smart PLS report

The HTMT index values are satisfactory and align with the thresholds established by Gold et al. (2001), Teo et al. (2008), and Henseler et al. (2015), except the variables GEI and GECOC, which exhibit an HTMT value approaching the 0.9 threshold.

Based on these results, it can be concluded that the first-order measurement models associated with the GM construct demonstrate reliability as well as convergent and discriminant validity.

4.2.2 Evaluation of first-order measurement models for the "Overall performance" variable

The dependent variable, "Overall Performance," is conceptualized as a second-order construct comprising four first-order dimensions: operational performance, environmental performance, social performance, and economic and financial performance.

Table 7: Indicators of the reliability of models for measuring "overall performance" first-order constructs

	Cronbach's alpha	Composite reliability (rho_c)	Average variance extracted (AVE)
PECFI	0,883	0,911	***0,674***
PENV	0,763	0,844	***0,579***
POPE	0,858	0,914	0,781
PSOC	0,821	0,879	0,721

Source: Smart PLS report

The values reported in this table indicate that the first-order constructs demonstrate reliability, as evidenced by composite reliability and Cronbach's alpha values exceeding the recommended threshold of 0.7. Additionally, the table confirms that most items contribute significantly to the construction of their respective latent variables, with values surpassing the 0.7 threshold. However, three items—PECFI3, PENV5, and PSOC2—exhibit values of 0.673, 0.618, and 0.524, respectively, which fall below the acceptable threshold. To improve the Average Variance Extracted (AVE) values, the removal of these items will be undertaken sequentially, beginning with PSOC2, followed by PENV5, and finally PECFI3.

Table 8: Convergent validity indices

	Items	Weight	AVE
Performance	***PECFI1***	**0,705**	
Economic and financial	***PECFI2***	**0,914**	***0,674***
	PECFI3	0,673	
	PECFI4	**0,920**	
	PECFI5	**0,860**	
Performance	***PENV3***	**0,878**	
Environmental	***PENV4***	**0,820**	***0,579***
	PENV5	0,618	
	PENV6	**0,700**	
Operational performance	***POPE1***	**0,922**	
	POPE3	**0,912**	**0,781**
	POPE4	**0,813**	
Social performance	***PSOC1***	**0,971**	**0,721**
	PSOC2	*0,524*	
	PSOC3	**0,973**	

Sources:Smart PlS report

The removal of the three items enhanced the reliability of the corresponding constructs, as reflected in the improved AVE values for PECFI, PENV, and PSOC, which now stand at 0.857, 0.648, and 0.779, respectively, as shown in Table 9 below.

Table 9: Reliability index for global performance constructs

	Alpha	Composite reliability	AVE
PECFI	**0,918**	**0,947**	**0,857**
PENV	**0,730**	**0,846**	**0,648**
POPE	**0,725**	**0,843**	**0,645**
PSOC	**0,726**	**0,875**	**0,779**

Source: Smart PLS report

In light of the above results, the first-order constructs of "Overall Performance" exhibit both reliability and convergent validity. It is now necessary to proceed with the assessment of their discriminant validity.

Table 10 Cross loadings:

	PECFI	PENV	POPE	PSOC
PECFI2	0,926	0,028	0,049	**-0,060**
PECFI4	0,933	0,009	0,054	**0,084**
PECFI5	0,919	0,131	0,103	**-0,011**
PENV3	-0,083	0,714	0,261	**0,061**
PENV4	0,079	0,841	0,282	**0,006**
PENV5	0,123	0,853	0,375	**0,011**
POPE1	0,104	0,249	0,825	**-0,099**
POPE3	0,078	0,382	0,896	**-0,070**
POPE4	-0,019	0,291	0,672	**-0,010**
PSOC1	0,053	0,014	-0,113	**0,928**
PSOC3	**-0,059**	**0,039**	**-0,009**	**0,834**

Source: Smart PLS report

The contributions of the indicators to their respective latent variables are higher than their contributions to other latent variables, as shown in Table 10. This indicates a strong correlation between the indicators and the latent variables they are intended to measure (Chin, 1998; Lacroux, 2011).

The second criterion for assessing discriminant validity is the Fornell-Larcker index, which ensures that the square root of the average variance extracted (AVE) for a latent variable exceeds its correlations with all other latent variables (Sosik et al., 2009). Table 11 below provides an illustration of this index.

Table11: Fornell-Larcker criterion index

First-class construction	PECFI	PENV	POPE	PSOC
PECFI	**0,926**			
PENV	0,067	**0,805**		
POPE	0,078	0,385	**0,803**	
PSOC	**0,009**	**0,027**	**-0,080**	0,883

Source: Smart PLS report

The third indicator of discriminant validity is the HTMT index (Heterotrait-Monotrait ratio of correlations), which is employed to assess the multicollinearity between the indicators of the latent variables. The HTMT is used to estimate the correlation between two latent variables, and this value must be below 0.85 (Kline, 2015), or 0.9 according to other scholars (Gold et al., 2001; Teo et al., 2008; Henseler et al., 2015). In the present model, the constructs meet the required threshold, as demonstrated in Table 12 below.

Table 12:Heterotrait-monotrait ratio (HTMT) - Matrix

	GAVTE	GCL	GECOC	GEI	GRINV	PECFI	PENV	POPE	PSOC
GAVTE									
GCL	0,147								
GECOC	0,125	0,072							
GEI	0,174	0,080	0,535						
GRINV	0,080	0,090	0,057	0,036					
PECFI	0,046	0,148	0,077	0,086	0,090				
PENV	0,101	0,035	0,253	0,417	0,167	0,141			
POPE	0,096	0,097	0,142	0,408	0,045	0,109	0,522		
PSOC	0,194	0,084	0,108	0,110	0,034	0,081	0,063	0,136	

Source: Smart PLS report

Based on the results presented in Tables 7, 8, 9, 10, 11, and 12, we can conclude that the first-order measurement models associated with the "Overall Performance" construct are both reliable and exhibit convergent and discriminant validity.

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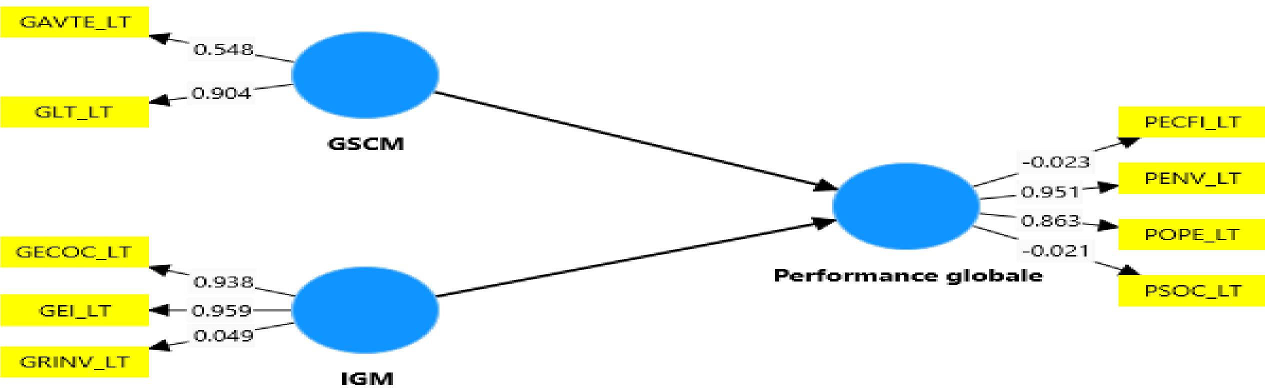
Having assessed the first-order constructs, we now turn to the evaluation of the second-order constructs, focusing on the relationships between these constructs and their corresponding first-order dimensions (Chin, 2010).

Given that the nature of our second-order constructs is reflexive-reflexive, we will assess them using the same validity and reliability criteria applied to the first-order constructs. However, we will first need to estimate their values. To achieve this, and in line with the two-stage approach, we will utilize the latent variable scores of the first-order constructs, which were previously calculated in the PLS-SEM phase.

4.2.3 Evaluation of second-order constructs: Internal Green Management (IGM), Green Supply Chain Management (GSCM) and overall performance

Based on the two-step approach, we estimated the value of the second-order constructs from the scores of the latent variables of the first-order constructs. We then proceeded to calculate PLS-SEM to test the reliability and the convergent and discriminant validity of the second-order constructs. Figure 4 below illustrates the estimation of the second-order constructs and the factor contributions of the first-order constructs.

Figure 4: PLS-SEM of second-order constructs



Source: Smart PLS report

The second-order construct GSCM is reflected by two first-order constructs "green purchasing" (GAVTE) and "cooperation with customers" (GLT). The second-order construct "IGM" is reflected by three first-order constructs "eco-design" (GECOC), "internal environmental management" (GEI) and "investment recovery" (GRINV), while the second- order construct "global performance" is reflected by four first-order constructs "economic and financial performance" (PECFI), "environmental performance" (PENV), "operational performance" (POPE) and "social performance" (PSOC). The reliability and convergent validity indices are presented in table 13 below.

Table 13 The reliability and convergent validity indices

Built to 2nd order	Built from 1er order	Loadings	AVE	Cronbach's Alpha	Composite reliability
GSCM	GAVTE	0,584	0,559	0,242	**0,705**
	GLT	0,904			
IGM	GECOC	0,938			
	GEI	0,959	0,601	0,499	**0,760**
	GRINV	0,049			
Per Globale	PECFI	-0,023			
	PENV	0,951	0,413	0,257	**0,571**
	POPE	0,863			
	PSOC	**-0,021**			

Source: Smart PLS

The results presented in this table indicate satisfactory composite reliability; however, the convergent validity, as measured by loadings, AVE, and Cronbach's alpha, suggests that certain adjustments are necessary for model validation. Initially, we will remove the first-order constructs with contributions below the required threshold of 0.7 (Hair et al., 2017), specifically PECFI, PSOC, and GRINV. We will retain the first-order construct GAVTE, despite its low Cronbach's alpha value (0.242), as the GSCM construct exhibits an AVE greater than 50% and composite reliability exceeding 0.7. The removal of these first-order constructs resulted in improvements in AVE, Cronbach's alpha, and composite reliability, as shown in Table 14 below.

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Table 1:AVE, Cronbach's Alpha and composite reliability

HOC	**LOC**	**Loadings**	**AVE**	**Cronbach's Alpha**	**Composite reliability**
	GAVTE	0,584	0,559	0,242	0,705
GSCM	GLT	0,904			
IGM	GECOC	0,938			
	GEI	0,959	0,906	0,897	0,951
Per Global	PENV	0,951			
	POPE	0,863	0,828	0,802	0,906

Source: Smart PLS

The second-order constructs' reliability and convergent validity indices are satisfactory, as shown in Table 15 below. We will now assess the discriminant validity of the second-order constructs using cross-loadings, the Fornell index, and the HTMT.

Table 2:Cross loadings

	GSCM	**IGM**	**Overall performance**
GAVTE_LT	0,463	0,068	**0,045**
GLT_LT	0,941	0,085	**0,117**
GECOC_LT	0,112	0,943	**0,636**
GEI_LT	0,080	0,961	**0,769**
PENV_LT	0,085	0,802	**0,951**
POPE_LT	**0,151**	**0,492**	**0,867**

Source: Smart PLS

Table 3:Fornell index

	GSCM	**IGM**	**Overall performance**
GSCM	**0,742**		
IGM	0,099	**0,952**	
Overall performance	0,120	0,744	**0,910**

Source: Smart PLS

Source: Smart PLS

We will subsequently evaluate the structural model after evaluating our first-order and second-order measurement models.

Table 4:HTMT

	(HTMT)
IGM <-> GSCM	0,223
Overall performance <-> GSCM	0,268
Overall performance <-> IGM	0,827

4.3. Testing of structural model

After validating the reflective, first-order, and second-order measurement models, it is essential to evaluate the structural model to highlight the causal relationships between the latent constructs (Hair et al., 2022). This evaluation involves assessing the model's predictive capacity and testing the formulated hypotheses. Hair et al. (2022) recommend examining collinearity among latent variables using the Variance Inflation Factor (VIF), evaluating explanatory power through the coefficient of determination (R^2), assessing the model's predictive relevance using the Q^2 value, determining effect sizes through F^2, and verifying the significance of the path coefficients using the t-test.

4.3.1 Assessment of model quality:

The quality of the model can be assessed using various indicators, including the coefficient of determination (R^2), the effect size (F^2), the redundancy index (Q^2), and the Goodness of Fit (GOF) index.

Table 5: Coefficients of determination R2

	R-SQUARE	R-SQUARE ADJUSTED
OVERALL PERFORMANCE	***0,555***	***0,548***
PECFI	0,032	**0,003**
PENV	0,150	**0,124**
POPE	0,121	**0,100**
PSOC	**0,052**	**0,024**

Source: Smart PLS

The overall performance demonstrates an R^2 value of 0.5482, indicating that green management practices account for 54.8% of its variance. It is important to emphasize that no universally established threshold exists for R^2 values to assess the explanatory power of exogenous variables on endogenous variables, as this depends on the specific research context (Hair et al., 2016). However, Falk and Miller (1992) recommend retaining constructs with R^2 values exceeding 0.10. Furthermore, the results reveal that these practices contribute to explaining both dimensions of overall performance: environmental and operational.

Table 6:F2 size effect

	F-SQUARE
GSCM -> GLOBAL PERFORMANCE	0,005
IGM -> OVERALL PERFORMANCE	1,216

Source: Smart PLS

This index evaluates the relative impact of an exogenous construct (in this case, GSCM and IGM) on an endogenous construct (overall performance) based on fluctuations in the R^2 value (Chin, 1998). The second-order construct IGM demonstrates a relative effect of 1.216, exceeding the threshold of 0.35, indicating a substantial effect size on overall performance. In contrast, GSCM shows no significant effect size on overall performance (Cohen, 1988).
The predictive power of the model is no longer evaluated using Q^2 (Hair et al., 2022). Instead, Shmueli et al. (2016) recommend employing the PLS prediction technique and calculating the

RMSE (Root Mean Square Error) and MAE (Mean Absolute Error) indices. According to Hair et al. (2016), RMSE is the most reliable indicator for assessing predictive power, although it can be replaced by MAE when prediction errors fall outside the -2 to +2 interval.

Table 7:PLSpredict MV Summary

	Q²PREDICT	**PLS-SEM_RMSE**	**PLS-SEM_MAE**	**LM_RMSE**	**LM_MAE**
PENV_LT	0,594	0,640	0,362	0,602	0,335
POPE_LT	0,147	***0,928***	0,394	***0,930***	0,401

Source SMART PLS

The positive Q² value allows for a comparison between the RMSE and LM_RMSE values. One of the RMSE values (0.928) is lower than the linear regression model's LM_RMSE (0.930), indicating that the model demonstrates average predictive power (Shmueli et al., 2016). To further evaluate the model, the goodness of fit (GOF) is assessed. The GOF is calculated as the geometric mean of the average variance extracted (AVE) and the mean R² of the endogenous variables, providing a comprehensive measure of the model's overall fit.

$$\mathbf{GOF = (0.584*0.308)^{1/2} = 0.424}$$

In alignment with the thresholds established by Wetzels et al. (2009), the model exhibits a high level of goodness of fit, as evidenced by a GOF value of 0.424, which surpasses the recommended threshold of 0.36.

To ensure the robustness of the model, a collinearity assessment was conducted to verify that the constructs are not excessively correlated, thereby avoiding potential biases in the parameter estimates (Hair et al., 2022). The Variance Inflation Factor (VIF) serves as a reliable indicator of collinearity among constructs, whether exogenous or endogenous. Hair et al. (2010, 2016, 2022) propose several thresholds for VIF, recommending values below 10, 5, or 3, depending on the research context.

In the present model, the second-order constructs—IGM, GSCM, and Overall Performance—display VIF values below 3, indicating that multicollinearity is not a concern. This conclusion is further supported by the data presented in Table 21, confirming the structural validity of the model.

Table 8: Collinearity statistics (VIF)

	VIF
GSCM -> Global performance	**1,010**
IGM -> Overall performance	**1,010**

Source SMART PLS

Based on the preceding analysis, it can be concluded that the structural model exhibits a high level of quality. The subsequent phase involves testing the hypothesized structural relationships between the second-order constructs to empirically validate the proposed theoretical framework.

4.3.2 Assessment of model assumptions:

To test the underlying hypotheses of the proposed model, we will employ the bootstrapping method, an iterative algorithm designed to stabilize the estimated values of the Beta (ß) regression coefficients and determine their statistical significance (Chin, 1998). The hypotheses are considered statistically significant at the 10%, 5%, and 1% thresholds when the p-values are less than 0.1, 0.05, and 0.01, respectively, and when the corresponding Student's t-values exceed 1.65, 1.96, and 2.57, respectively.

Table 9:Assessment of assumptions

	Original sample (O)	Sampl emean (M)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P values	Validation
GSCM -> Overall performance	0,055	0,057	0,086	0,632	0,527	**rejected**
IGM -> Overall performance	0,753	0,760	0,049	**15,370****	**0,000**	**Confirmed**

$^{**}p<0,01$

Source SMART PLS

As shown in Table 22, internal environmental management (IEM) practices are positively correlated with overall performance. The Student's t-value is 15.37, with a significance level of 1%, and the Beta regression coefficient (ß) is 0.76, indicating that IEM practices account for 76% of the variance in overall performance. This supports the confirmation of hypothesis H1, which posits a positive relationship between internal environmental management practices and overall performance.

In contrast, Green Supply Chain Management (GSCM) practices do not exhibit a statistically significant impact on overall performance. The Student's t-value is 0.632, which is below the threshold of 1.65, and the p-value is 0.527, exceeding the 0.1 threshold, thus indicating that the relationship between GSCM practices and overall performance is not statistically significant. Consequently, hypothesis H2, which suggests a positive association between GSCM practices and overall performance, is rejected.

5. Discussion :

The hypothesis of our research asserts that GSCM practices positively influence overall performance, a conclusion that is substantiated by our empirical findings. Specifically, GSCM within the context of Moroccan industrial firms emerges as a catalyst for operational efficiency and effectiveness, notably through cost reductions in production and transportation (e.g., waste minimization, use of recycled materials, inventory reduction, supplier-managed inventories, and optimization of transportation means). GSCM also fosters strong, long-term relationships with socially responsible suppliers, thereby enhancing the company’s brand image, strengthening its reputation, and increasing its appeal to socially responsible investments (SRI). This, in turn, contributes to greater customer loyalty, particularly among those who are more attuned to environmental issues.

These findings are consistent with prior research, which has shown that internal environmental management, collaboration with customers and suppliers, green procurement, eco-design, and the promotion of socially responsible investments all contribute to improved operational performance (Green et al., 2012; Jabbour et al., 2016). Therefore, we can conclude that the empirical evidence supports the validation of our hypothesis.

The positive relationship between GSCM practices and environmental performance is also confirmed by our empirical study. This result aligns with prior research, which has shown a positive link between GSCM and environmental performance. Notable studies include those by Jabbour et al. (2016) in Brazil, Zhu and Sarkis (2004), Lai and Wong (2012) in China, Hajmohammad et al. (2013) in Canada, Lee (2013) in Korea, Zhu et al. (2010) in Japan, and Gunasekara and Aruna (2023) in Sri Lanka.

In our study, internal environmental management practices were the most strongly correlated with environmental performance. This includes senior management commitment, middle management support in implementing GSCM activities, and integrating environmental

considerations into total quality management. Additionally, practices such as ongoing environmental compliance through audits, environmental labeling, ISO 14001 certification, and the establishment of environmental management systems were crucial.
This outcome can be explained by the fact that many companies in our sample operate in the aerospace sector (26%). These companies are suppliers or subcontractors for major aviation manufacturers such as EADS, BOEING, SAFRAN, and others. These firms have high environmental standards and select suppliers based not only on traditional criteria (quality, cost, delivery) but also on their environmental commitment. Moreover, a significant portion of the automotive sector consists of multinational companies with environmental management systems in place across their global sites. These companies adhere to CSR requirements, particularly regarding carbon footprint reduction, and engage in environmental reporting. This ecosystem promotes the diffusion of good environmental practices across all industry stakeholders.
The findings of this study indicate that GSCM practices, which involve extending environmental commitment beyond the company's boundaries—specifically in supplier relations (Green Purchasing) and customer cooperation—do not significantly contribute to the improvement of overall performance in the Moroccan industrial context. Consequently, the H1 hypothesis is not supported. This outcome may be attributed to the early stage of GSCM adoption in Moroccan industrial SMEs, as 90% of the surveyed companies employ fewer than 200 employees. As such, these organizations may need to reconsider their management practices, which tend to be family-oriented and short-term focused.
On the other hand, the study demonstrates that a heightened awareness of sustainable development issues, particularly through internal environmental management, investment recovery, and eco-design, leads to a significant improvement in overall performance. Therefore, the second hypothesis (H2) is affirmed. The findings suggest that Moroccan companies prioritize internal environmental management over external management, which necessitates collaboration and coordination across the supply chain. The existence of a supply chain governance system, underpinned by contractual agreements and trust, may be a key factor in fostering sustainable inter-company relations and promoting the expansion of environmental commitment throughout the Moroccan supply chain.

6. Conclusion

This article examines the impact of environmental commitment on the overall performance of Moroccan industrial companies. The first section provides a comprehensive review of the GSCM concept in the literature. Initially, we outlined the processes inherent in GSCM, following the model recommended by the Supply Chain Council (SCC). We then discussed the key pillars of GSCM based on various conceptual models proposed by scholars in the field.
From this, we selected the model by Zhu, Sarkis, Cordeiro, and Lai (2008) to operationalize the GSCM concept. This model effectively divides GSCM practices into two categories: an internal block, which encompasses all environmental operations within the company (internal environmental management), and a second block, which extends environmental practices beyond the company's boundaries, including green purchasing, eco-design, and customer cooperation. We also defined global performance across four dimensions: environmental, social, operational, economic, and financial.
The second section of the study tested the impact of environmental commitment on overall performance through an empirical approach, using a questionnaire distributed to 300 companies. The problem was addressed using structural equation modeling, with our conceptual model broken down into several measurement scales. These scales helped assess the extent of GSCM implementation in Moroccan companies and measure specific global performance indicators. We also presented a structural model to examine the relationships

between GSCM practices and overall performance. Using PLS-SEM and the Smart PLS software (4th version), we tested the validity and reliability of the first-order and second-order constructs, followed by bootstrapping and PLS prediction to validate the structural model and test the hypotheses based on the literature.

Our findings revealed that GSCM practices, particularly those that extend environmental commitment beyond the company to include supplier relations (Green Purchasing) and customer cooperation, do not significantly impact overall performance in the Moroccan industrial context. Consequently, the H1 hypothesis was rejected. This may be explained by the early stage of GSCM implementation in Moroccan industrial SMEs, with 90% of the surveyed companies employing fewer than 200 employees. As such, these companies may need to reconsider their management practices, which are often family-oriented and short-term focused. Conversely, our study found that awareness of sustainable development issues, particularly internal environmental management, investment recovery, and eco-design, significantly improves overall performance. This confirms the second hypothesis (H2). The results suggest that Moroccan companies prioritize internal environmental management over external practices, which require coordination across the supply chain. The presence of a governance system based on contracts and trust may encourage sustainable inter-company relations and expand environmental commitment throughout the Moroccan supply chain.

This study offers a starting point for modeling the impact of GSCM on overall performance in Moroccan industrial companies. Future research could incorporate moderating factors such as company size, expertise, environmental labeling, regulatory pressures, corporate culture, and supplier bargaining power. Additionally, the model could include mediating variables such as staff involvement and motivation to further explore their direct and indirect effects on overall performance.

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