



Original research article

Adoption of GSCM Practices and Sensitivity/influencing Factors: An Empirical Study at the Moroccan Firm Level

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ABSTRACT

GSCM (Green Supply Chain Management) is a concept that aims at the environmental dimension of sustainable development. Many factors influence the decision to adopt a green strategy, which is also an important indicator in determining the adoption level of its practices. In this article, based on a literature review, we propose a theoretical model that shows a hypothesis on the relationship between ten sensitivity factors and the level of adoption (LA) of GSCM practices (GSCMPs). Using the linear multiple regression method on collected data from a survey of Moroccan companies, we confirmed or invalidated the relationships in our model. Finally, we retained the operational model that shows the impact of the two main factors on the approval of GSCM practices: the importance of early adoption of environmental practices (EAEP) and top management commitment (TMC). Organizations can use this model to improve their GSCM practices and enhance their LA. The analysis results can also provide insights for future research on GSCM and LA.

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1. Introduction

Nowadays, the company's success is no longer measured only by its earnings but also through the extent to which it integrates environmental concerns into its strategy. Thus, the company's management level is closely linked to its environmental responsibility. GSCM (Green Supply Chain Management) is an approach much appreciated by researchers and professionals as it responds to the growing trend in favor of ecological management and to face the chal-

lenges of climate change. It has become a priority for many companies due to increasing environmental awareness and increasingly stringent government regulations [1]–[3]. According to [4], GSCM can be defined as the environmental considerations integrated throughout the supply chain management process. It encompasses various stages such as product design, material sourcing, selection of manufacturing methods, delivery to consumers, and post-consumer product management. For better implementation of the GSCM approach, it is crucial to study the factors that influence the adoption of GSCM practices can help

companies understand potential barriers to adopting these practices and how to overcome them. By understanding these factors, companies can develop strategies to encourage GSCM practices adoption such as employee training, stakeholder engagement, working with suppliers, and setting up incentive policies.

In Morocco, the first ecological actions in the supply chain were presented in the national logistics strategy in 2010 [5]. Knowing that the number of companies in Morocco amounts to nearly half a million, the number of those having adhered to the Green Logistic Charter (GLC) represents a percentage of 0.016% of all companies in Morocco [6]. Following this information, we decided to study influencing factors on the company's commitment to environmental matters, especially concerning the GSCM approach to know the reason for this low percentage. For this purpose, we analysed our survey sent to Moroccan companies on the state of the GSCM approach in Morocco. Moreover, we have found from the literature that in countries which have strict environmental laws, regulation is the main driver for GSCM practices adoption [2], [7]–[9]. On the other hand, in countries where environmental regulatory requirements are still in their infancy, the factors influencing the GSCM approach remain unclear and under-emphasized. This work could constitute a significant reference for improving the environmental situation of companies in these countries. Especially in Morocco, studies in this area are scarce. The most focus on the integration of these approaches with others, such as Lean, resilience, Lean six sigma, Big Data and Smart [10]–[13]. Thus, it is evident that Moroccan researchers have not adequately focused on the GSCM approach, and the environmental aspect has not been emphasized and framed adequately. This represents a significant weakness in the majority of published works, in our opinion. In parallel, in studies by researchers from other countries that have examined the factors influencing the adoption of GSCM practices, we have noticed that most researchers have included the social aspect in their GSCM approach [14]–[16], while, for us, this approach has an ecological/economic double interface rather than a social one, this result was demonstrated in our previous study [17]. Therefore, in our work, we chose not to consider the social aspect in our influencing factors selection.

The objectives of the present research are:

- understand the factors that influence the company's environmental compliance, especially regarding the GSCM approach adoption, in

countries where the green industrial agenda is still voluntary and not framed by strict environmental laws.

- propose recommendations adapted to their specific context to improve the ecological situation of companies in these countries.

To accomplish the outlined objectives, we formulated the following research question:

- To what extent do influencing factors impact the level of adoption of GSCM practices, and which factors are most important?

To what extent do influencing factors impact the level of adoption of GSCM practices, and which factors are most important?

In order to address this inquiry, we conducted an analysis of the correlation between the influencing factors and the LA of GSCMPs in Moroccan companies. The ten factors studied are the age of the company (AG), activities sector (AS), Size of the company (SZ), Adoption of environmental practices (AEP) or possession of an EMS (environmental management system), early of AEP (EAEP), Regulations (RGL), Training and education of employees (TEE), Human behavior of employees (HBE), Seniority of employees in the function (SEF) and Top management commitment (TMC), they classified into four categories: organizational, contextual, individual and managerial.

The paper is organized as follows: In the first section, we proposed our theoretical framework, which contains the classification of influencing factors and the GSCM approach practices and hypotheses on the relationships between the ten influencing factors and the LA of GSCMPs. Therefore, we have shown the conceptual research model expresses the relationships studied between the dependent variable and independent variables.

The second part of the study outlines the methods and techniques employed, a review of the literature, a questionnaire survey, descriptive statistics, and multiple regression analysis. We use literature to identify dependent and independent variables to suggest hypotheses on the relationship between them. We used descriptive statistical techniques and the method of multiple linear regression to process the sixty-three valid answers to the questionnaire. The third section presents the results of the analysis carried out on the SPSS software. The fourth section is the discussion part, discussing the most significant elements found in the results. The conclusion and indications for future research have been presented in the last section.

2. Literature review

2.1. GSCM approach practises

The increase in greenhouse gas emissions adversely affects the Earth's ecological balance. [18]. Organizations must take a legitimate perspective on GSCM and put GSCM into practice. One such approach might be to focus on saving energy and minimizing emissions in supply chain and operations management [19]. [20] investigated the effect of moderators on the relationship between GSCMP adoption and environmental and economic performance. They classified 21 green practices into five categories, internal environmental management, green procurement, eco-design, customer collaboration, and investment recovery. In addition, [21] developed a structural model in which they represented the relationships between several factors within the framework of GSCM implementation. Internal green practices and external green collaboration are two types of practices studied. The first practice contains seven elements second regroups eight items. [16] investigates the importance of Critical Success Factors (CSFs) for GSCM implementation. The dependent variable studied is the GSCM practices related to sustainability classified according to the six GSCM projects: green design, green purchasing, green produc-

tion, green management, green marketing, and green logistics.

According to the green supply chain scope proposed in the work of [16] we classified the GSCM practices according to six departments shown in Table 1. There are a large number of GSCM activities in the literature. However, we cannot include them all in our questionnaire because the GSCM approach is still new in our country, and the activities are even more modest than those studied in the literature. Therefore, we selected those that appear most frequently in the annual activity reports of Moroccan companies that adopt green friendly measures. The selection of companies was not random but based on a list of companies that have signed the Charter for a Green Logistics Chain. For this reason, we selected three items for each practice in our study.

[22] found through a systematic literature review that there are two types of practices for green design. The first is related to the management aspect, which involves the participation of the resources and staff concerned, the clear identification of a strategy that respects the rules, the indicators, and the objectives (those within the framework of the legislation), and a methodology to use in case of peak resistance and failure. The second aspect concerns the operational structure that leads to the formulation of a plan that focuses on reducing energy and material consump-

Table 1. GSCM approach practices

Practices	Items	Sources
Green Design	<ul style="list-style-type: none"> • Design for recycling • Product life cycle analysis respecting environmental principles • substitution of dangerous and polluting materials by other safe and clean ones 	[4], [20], [33], [36]–[42]
Green purchasing	<ul style="list-style-type: none"> • purchasing environmentally friendly products (recyclable content, non-toxic etc.) • The cooperation with suppliers has an environmental management system • Environmental auditing of suppliers/vendors' 	[4], [20], [36], [43]–[49]
Green Production	<ul style="list-style-type: none"> • Reduction in energy consumption • Decreasing Air Emissions, Liquid and Solid Waste • Utilization of Cleaner Technology 	[16], [50], [51]
Green Management	<ul style="list-style-type: none"> • Obtaining certification to ISO: 14001 or other EMS within the organization • Environmental compliance & auditing programs • Suggestion box to improve the environmental situation 	[20], [36], [46], [52]–[55]
Green Marketing	<ul style="list-style-type: none"> • Use of green packing of the products • Sale of scrap & used material • Regular voluntary information on management to customers and institutions 	[16], [55]–[58]
Green Logistics	<ul style="list-style-type: none"> • Use of environmentally friendly transportation • Transport flow optimization • Refurbishment of returned components or products 	[4], [51], [59]–[61]

tion, extending the life of materials and products, and choosing processes and resources with minimal environmental impact. [4] defined three types of activities in the eco-design department, green manufacturing and remanufacturing, reverse logistics and network design, and waste management.

The first external practice of the GSCM approach is green procurement, which is considered by [23] as an emerging approach in Chinese enterprises based on the internal or upstream link between the product supply chain and an organization at that time. The purchasing function contributes to the environmental reduction impacts and paves the way for ecological integration principal into all other departments and all areas of a company [24].

According to [25], green manufacturing includes three dimensions or pillars: energy, processes, and materials. He defines it as "the production of products using processes that minimize negative impacts on the environment, conserves energy and natural resources, and are safe for employees, communities, and consumers." sustainable manufacturing is based on a 6Rs innovation methodology that includes not only the 3Rs of "reduce," "reuse," and "recycle," but also "recycle," "redesign," and "remanufacture" products over multiple life cycles [26].

Typically, green management innovation is initiated when a company gains new knowledge about environmental issues or introduces innovative environmentally friendly products and processes [27]. However, most traditional green management practices are unable to achieve the ecological goals of the green innovation process, so the company often pays for its poor environmental performance and reputation among its supply chain partners [28]. From this perspective, it is necessary to integrate all supply chain functions so that a new approach is an integrated approach and not just a set of internal management procedures, and from this perspective, the company can be competitive in the marketplace and carry weight and value with supply chain partners. Moreover, it is not enough to adopt green practices to be competitive in this field. There is another profession that carries out the process of increasing competitiveness in the marketplace, and that is the profession of marketing. Green marketing strategies must be used to achieve a competitive advantage [29], [30].

Companies can reduce their environmental footprint by adopting green logistics practices while improving quality, reliability, energy efficiency, cost savings, and other related benefits [16], [31], [32]. Green logistics cannot be realized if the return process is not considered. The green logistics strategy encompasses

various activities such as recycling, reusing, refurbishing, repairing, and safely removing products by returning them from the point of consumption to the supply chain. [33], [34].

2.2. Hypotheses and Conceptual Framework

On the occasion of COP22 in Marrakech, the Moroccan Agency for the Development of Logistics (MALD), in collaboration with the General Confederation of Moroccan Enterprises (CGEM), launched a Moroccan Green Logistics Charter (GLC). More than 50 companies have signed the GLC, which ensures maximum mobilization of the Moroccan logistics community (institutions, shippers, logistics companies, etc.), presents best practices in "green logistics" and provides a framework for sharing experiences in green logistics. Considering that there are almost half a million companies in Morocco, the number of those who have joined the GLC corresponds to a percentage of 0.016% of all companies in Morocco. This percentage is low compared to other countries. According to the Green Supply Chain Observatory, 2008: Japan indicates that the companies in the surveyed sample are fully involved in a green supply chain approach, while in Europe country this percentage is only 38%, with a high difference between the United Kingdom with 45% and France with 30%, in the United States it is only 24%.

In this work, we used 10 of 13 hypotheses proposed in our previous work on the factors influencing the LA of the GSCMP. Therefore, we suggested the several hypotheses that define the relationship between the LA of the GSCMP and some sensitivity factors in Table 2. Based on these assumptions, we develop the theoretical model shown in Figure 1. We validated it using a multiple regression test.

Table 2. Hypothesis on sensitivity factors to adoption of GSCM (Our previous work has been agreed to publish at the end of March 2023).

After conducting an extensive literature review on the four categories of factors that impact the LA of GSCMP, we proposed hypotheses on the relationship between the subfactors of the four categories and the LA of GSCMP.

Each study referenced in Table 2 in the hypothesis formulation is conducted in a specific context and uses different methods. Likewise, in our work, we put forward diverse lists of factors and employed a questionnaire distributed among individuals in various contexts, potentially yielding disparate outcomes. Indeed, the results may vary depending on the characteristics of the participants, the contexts in which they

Table 2. Hypothesis on sensitivity factors to adoption of GSCM [62]

Type of factors	Hypothesis	Source
Organizational Factors	H1: the AG of the company influences the LA of GSCMP	[61], [63], [64]
	H2: the SZ of the company influences the LA of GSCMP	[63]–[66]
	H3: The AEP in the company influences the LA of GSCMP	[67], [68]
	H4: EAEP in the company influences the LA of GSCMP	[69]
Contextual Factors	H5: the AS of the company influences the LA of GSCMP	[70] [14], [34], [71]–[75]
	H6: RGL influences the LA of GSCMP	[76], [26],[77] [7] [2], [8], [70], [78]–[81]
Individual Factors	H7: TEE influences the LA of GSCMP	[82]–[84]
	H8: SEF influences the LA of GSCMP	Authors
	H9: the HBE influences the LA of GSCMP	[85], [86]
Managerial Factors	H10: TMC influences the LA of GSCMP	[15], [45], [74], [84], [86]–[91]

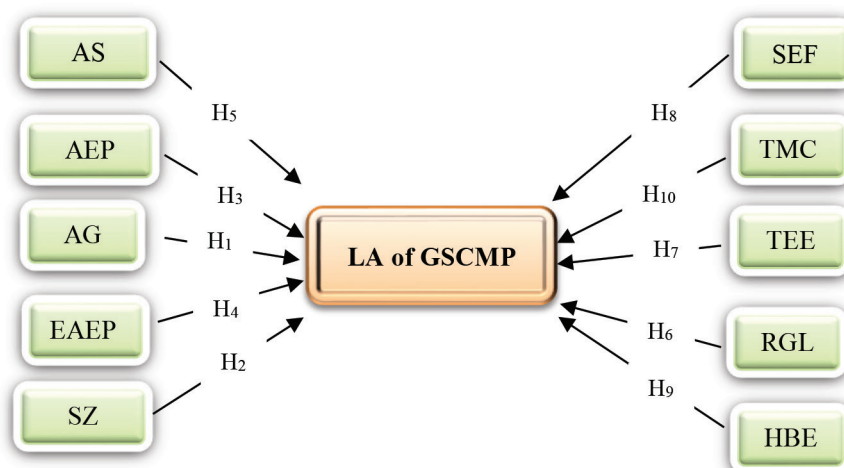
find themselves, the data collection methods used, etc. Several studies have shown the influence of the study context on the data survey results. For example, a study [92] showed that the order of questions in a questionnaire affects participants' responses. Identically, a work by [93] showed that the data collection period affects participants' responses due to changing attitudes and opinions over time. Concerning the sample size, research conducted by [94] showed that differences in cultural factors influence participants' answers to a questionnaire. Indeed, attitudes, beliefs, and values can vary from one country to another, which can affect the participant's answers. Moreover, regarding the data collection method, a study [92] showed that the data collection method affect participants' responses. For example, participants may be more likely to give socially acceptable answers when answering a questionnaire face-to-face rather than over the phone or online. Therefore, these studies show that the study context can have a significant impact on the results of the data survey, and therefore

one should avoid generalizing the study conclusion to different circumstances.

We determined a conceptual model (figure 1) showing the proposed hypotheses to be verified by the appropriate techniques and methods. There are many sensitivity factors that we can study their effects on the LA of GSCMP. Therefore, we considered a list of ten influence factors that are examples and not exhaustive (AG, SZ, SA, ESF, AEP, EAEP, RGL, TEE, HBE, STM).

2.2.1. Dependent Variables

The dependent variable is the six functions of the GSCM approach, of which we examined three items in each department. For each item, we formulate a Likert question on a scale of 1 to 5 (5 = successfully implemented, 4 = initiated implementation, 3 = currently under consideration, 2 = planning, 1 = not under consideration). We calculated the average of responses to each item, representing the LA of prac-

**Figure 1.** Conceptual model

tices according to the GSCM function to which they belong. Then we calculated the average of responses in six departments that represent the LA of GSCMP. Thus, we will have a dependent variable of a continuous numerical type that can use in the multiple regression method.

2.2.2. Independent variables

We have ten factors that affect the LA of GSCMP. The SZ; AS; AG; SEF; AEP; and EAEP factors were introduced in five questions. For RGL; HBE; TEE; and the TMC combined into one multiple-choice question asking about the factors influencing the introduction of GSCM procedures. We then coded each item into a separate variable. We proposed the conceptual framework of this paper that shows the proposed hypothesis.

3. Research Methodology

3.1. Methodology of the article

We have proposed a theoretical model from a literature review on the influencing factors of GSCM using Google Scholar for its broad coverage in scientific research and for the speed and ease of access and display. To test the hypothesis proposed, we surveyed Moroccan companies. The collected data were analyzed using the multiple regression method to identify the significant factors that affect the LA of GSCMP. We used the SPSS software version 23.0 for this purpose. We checked data for normality, linearity, and multicollinearity indicators. The final model will include the main factors affecting the LA of GSCMPs using the regression linear multiple methods.

3.2. Instrument development and data collection

Questionnaires are an essential tool for gathering information in research. However, before drafting a questionnaire, it is crucial to define the general hypotheses and objectives of the survey. In our particular case, validating our hypotheses necessitated examining all categories of Moroccan companies. Moreover, our goal was to gather extensive information on GSCM in Morocco, considering that the concept is still in its early stages within our country. Therefore, we did not recommend filtering the total number of companies by size or/and age, etc. More-

over, the preliminary studies should give a general idea of the concept and lead later to specialization by filtering. However, to study GSCM practices in local companies, we chose not to include foreign companies that have established their branch in our country. We took this approach to mitigate the impact of external factors, such as supply chain management policies and practices from other countries, on our research outcomes. By excluding these foreign companies, we directed our attention toward the GSCM practices of local companies, enabling us to derive more precise and contextually relevant results.

The sampling approach utilized a random selection process to ensure the sample's representativeness. The main source utilized to construct the sample was The Kompass, a directory containing information on 40,000 Moroccan companies. The sample size consisted of 63 companies, resulting in a margin of error of $\pm 8\%$. We utilized a combination of postal and electronic means to distribute 260 questionnaires, with 60 sent by post and 200 sent electronically. Our response rates were 16% for the postal questionnaires, with ten returned, and 30% for the electronic questionnaires, with 55 returned. Additionally, we conducted face-to-face data collection by consulting with ten companies on-site, resulting in 5 companies agreeing to meet with us and a response rate of 50%. Overall, we received 70 complete responses, representing an initial response rate of 26%. However, 9 of these responses were unusable due to insufficient data, resulting in a final response rate of 22.4%. The questionnaire (for details see Annexure) was developed based on a previous pilot study by the Supply Chain Observatory in 2008, tailored to the specific context of Moroccan companies.

3.3. Data analysis techniques

Multiple regression analyses are valuable tools for examining the associations between a single dependent variable and two or more independent variables [95]. We used these tools to determine the influence of sensitivity factors on the LA of GSCMPs. The regression process predicts or estimates the behavior of a specific element or phenomenon (known as the dependent variable) based on various combinations of explanatory factors (known as independent variables). Therefore, we will see the possibility of determining the LA variance of GSCMP using a linear regression of the ten influencing factors. We checked the condition of no perfect multicollinearity (more than 0.9 or -0.9) between two or more independent variables with the VIF (Variance

Inflation Factor), which indicates whether one independent variable has a strong linear relationship with the others. The arbitrary rule is applied in that a value of this index greater than 10 indicates such a problem presence. The regression method is chosen backward; SPSS removes the variable with the lowest contribution to the model if the change in R2 is not significant by eliminating it. The procedure repeats until all variables are retained to contribute to improving the R2 indicator. All variables evaluated are entered simultaneously, and an F-test evaluates the entire model.

Cronbach's alpha is a meaningful measure for assessing the validity of data collected with a questionnaire. Its purpose is to examine the internal consistency of the questionnaire. According to [96], a value greater than 0.5 is considered acceptable for this indicator.

4. Results

4.1. The profile of the participants: size, age, and sector of activity of the company

To properly represent our sample, we interviewed large and small medium-sized companies, most active companies in this survey are large companies (percentage of 83%), and although we insisted on asking all types of companies, we received more responses from large companies than from small companies, these results showing that large companies are the most interested in responding to this type of survey;

The company's age reflects the times and mental representations shared in the company [97]. and makes it possible to guess the progress made in this company on technology, know-how, new approaches, etc.

In our study, we considered the oldest companies created before 2000, whereas we pose that companies established after 2010 are young, and companies established before 2000 are the most participant in this survey (68% of the total number of participants), while youthful companies present 20.

There is a diversity of companies' sectors of activities participating in the survey, percentage of 63% of the responding people combined in five sectors of activity, Agro-food; Distribution; BTP; Production; and banking sector, and more than 70% of the survey participants hold the following positions: sales manager or manager, general manager/member of commercial, administrative, purchasing, IT, method, or project.

4.2. Profile of green companies

We have considered green companies as those that have adopted green practices, whether they create them with an environmental management system or follow a simple application at the operational level. In Figure 2, we observe that 88,9% of the companies surveyed adopted green thinking in their companies; this is a large percentage compared to the answer guessed from the literature and the participants on the GLC, which does not exceed 0.016% of the total number of Moroccan companies.

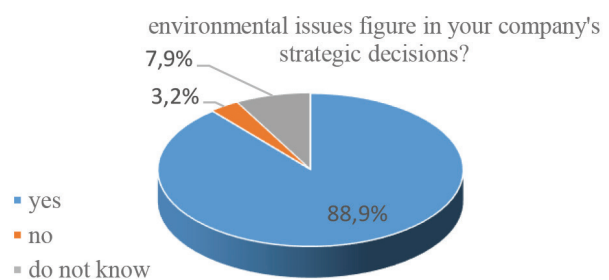


Figure 2. The responses of the interviewees on AEP

84% of green companies are large companies, more than 76% of them are old companies, and five sectors of activity (agrifood, production, construction, distribution, and services) account for more than 50% of green companies. Transport represents 4% of all companies that responded positively to the La of GSCMPs, while it represents 61% of companies involved in GLC in 2016.

4.3. Analysis of questionnaire data

The evaluation of reliability and validity is crucial to assess the effectiveness of any measurement procedure. [16]. We intended descriptive statistics to structure and represent the information stemming from the data collected on the LA of GSCMP in Morocco and to know the current trend of the variables affecting the LA of GSCMP. Multiple linear regression is a technique used to explain or predict the variability of a phenomenon (dependent variable), in this case, the implementation of the six GSCM practices, by using a combination of explanatory factors (independent variables).

4.3.1. Reliability, Validity Analysis, and Descriptive Statics

We managed to collect 63 valid answers to the questionnaire. Therefore, We exceed the require-

ment of 10 people per item (10*6) recommended by most works; the number six is the number of items in the DV. All correlations between IV items are less than 0.9. Thus, we did not include items that identically predict DV. For the internal consistency test, and according to [98], Cronbach's alpha values greater than or equal to 0.6 are considered acceptable for small samples. In our case, we had a value of 0.908 means excellent reliability of our questionnaire. All correlations between GSCM practice items are within the acceptable range recommended by [99] (more than 0,4). We validated the sampling adequacy measured by the KMO index (=0.86) and the sphericity of Bartlett ($p < 0.0005$ is significant), which leads us to reject the null hypothesis that the population of our study presents an identity matrix. Therefore, the correlations are not all equal to zero.

From Table 3, we noticed that all the averages of the responses to the LA of GSCMP are neither higher nor lower than 2. Furthermore, Moroccan companies are not under pressure to improve their situation on environmental issues because the GSCM approach has not yet acquired its broad scope and regulatory image in Moroccan companies. We found that most green activities intend to consider fall under the green production function (mean = 2.9841). All green production items have an average utmost than (mean= 2.9) close to the answer (3=considering currently). The least implemented activities attributed to the green design (mean = 2,4286).

4.3.2. Results of Multiple Regression Analysis

Using the multiple linear regression method, we explain (or predict) the variance of GSCM practices adoption using a linear combination of sensitivity factors from the generalization of the algebraic equation.

Table 4 shows that F-values are significant at $p < 0.001$, indicating that we have less than a 0.1% chance of being wrong in asserting that the models help predict the adoption of GSCM practices.

The backward method for multiple regression keeps two variables affecting the dependent variable after removing the nonsignificant variables. The SPSS program removed the least contributing variable in the model by looking at the variance R2. SPSS software will eliminate him if it is not significant. The procedure repeats itself until all the variables kept in the last model contribute significantly to the improvement of R2. Model 9 is the final model retained; it predicts the impact of sensitivity factors (independent variable) on the LA of GSCMP (dependent variable) in Moroccan companies. The regression equation to predict the dependent variable is as follows:

Model 9: Adoption of GSCM practices = $1,31 + 0,221$ (Early of AEP) + $0,498$ (TMC).

We tested the final model for error independence using the Durbin-Watson value, which was less than 2.0. Furthermore, we checked the multicollinearity using the variance inflation factor (VIF), and all variables have a VIF of less than 10. for the variability explained by the regression model, 30% (R^2 %) of LA of GSCMP is explained by the combination of "EAEP" and "TMC" factors, according to [16], a percentage of 30% considered among the acceptable rang. The coefficient signs tell us about the direction of the relationship between the variables. In our case, when companies take early environmental action, the LA of GSCMP increases (according to the Likert scale: 1(not considering) to 5(implementation successfully)). We also see that when the TMC increases (going from 0 for (no) to 1 for (yes)), the AL of GSCMP increases. The coefficient also tells us about the impact degree to which each predictor influences the variable, depending on whether all other predictors are constant. For us, the TMC predicts the dependent variable "LA of GSCMP" (a coefficient of 0.498) better than "the EAEP" (a coefficient of 0.221). According to model 9, we supported the hypotheses H4 and H10 and rejected H1, H2, H3, H5, H6, H7, and H8.

Table 3. The correlation matrix between DV items, the mean, and standard deviation

Variable	1	2	3	4	5	Mean	Std. Deviation
1 Green Design	1,000					2,4286	1,10299
2 Green purchasing	0,849	1,000				2,6032	0,94254
3 Green Production	0,545	0,582	1,000			2,9841	0,87052
4 Green Management	0,535	0,590	0,691	1,000		2,6984	0,79585
5 Green marketing	0,694	0,732	0,582	0,625	1,000	2,6032	0,77334
6 Green Logistics	0,569	0,640	0,677	0,650	0,530	2,5714	0,83694

Table 4. Multiple regression analysis outcomes that investigated the effects of ten factors on the LA of GSCMP

p	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
(Continuous)	1,03** (1,15)	1,10** (,511)	1,33** (,397)	1,37** (,395)	1,28** (,383)	1,25** (,384)	1,46*** (,341)	1,19*** (,292)	1,31*** (,286)
TEE	-0,02 (,019)	-,025 (,018)	-,025 (,018)	-,023 (,018)	-,022 (,018)				
ESF	0,09 (0,02)	,086 (,117)							
SZ	0,02 (0,30)								
SA	0,03 (0,02)	,034 (,022)	,032 (,022)	,036 (,022)	,031 (,021)	,025 (,020)			
AG	-0,13 (0,15)	-,139 (,125)	-,135 (,125)	-,121 (,124)	-,168 (,114)	-,182 (,113)	-,174 (,114)		
AEP	0,31* (0,16)	0,31** (,153)	,318** (,153)	,306** (,152)	,272* (,148)	,254* (,147)	,229 (,147)	,240 (,147)	
AEP	0,15** (0,07)	0,15** (,067)	,158** (,067)	,160** (,067)	,167** (,066)	,170** (,066)	,170** (,067)	186** (,067)	,221*** (,064)
HBE	0,18 (0,21)	,189 (0,201)	,193 (0,200)						
RGL	-0,22 (0,24)	-,229 (0,211)	-,266 (0,204)	-,175 (0,182)					
TMC	0,52** (0,18)	0,52** (,174)	,498** (,168)	,540** (,162)	,511** (,159)	,499** (,160)	,484** (,160)	,460** (,16)	,498** (0,161)
F	3,667**	4,151***	4,642***	5,177***	5,893***	5,893***	6,722***	7,965***	9,616***
R	0,643	0,643	0,638	0,63	0,622	0,609	0,595	0,573	0,546
square R square	0,41	0,41	0,41	0,40	0,39	0,37	0,35	0,33	0,30
Adjusted R Square	0,30	0,31	0,32	0,32	0,32	0,32	0,31	0,29	0,28

Notes: ***p<0,001; **p<0,05; *p<0,1

5. Discussion

Model 9 presents multiple linear regression results that are statistically significant, accounting for 54% in the dependent variable, supporting two hypotheses (H4 and H10), and rejecting the eight hypotheses. H4 and H10 relate to the influence of EAEP and TMC on the AL of GSCMP. These two factors have forced Moroccan companies to adopt GSCMP. TMC is the most significant factor in the LA of GSCMP. It positively affects the dependent variable. The EAEP is also a meaningful element to encourage companies to implement GSCMP.

Figure 3 shows that GSCM activities are implemented similarly and consistently across all company departments. The average scores are not above (average=2.9), are proximate to the answer (3 = currently considering), and not below (2 = planning considering). The highest value is assigned to

activities that fall under green production practices, and the lowest is attributed to those that fall under green design practices. These results are inconsistent with those elaborated by [100]. Their results showed that green design is the most adopted practice, followed by green collaboration coordinated between purchasing, marketing, production, and human resources. We can first explain this by the difference in the instruments used. In our work, we used a questionnaire with a response rate of 22.4%, while his study based on interviews in different sectors and secondary research data. Second, of the difference in time between the two studies, especially between 2018 and 2023, Morocco has experienced a radical transformation in the environmental sector, including an increase in voluntary commitments to reduce greenhouse gas emissions, the inclusion of territories in climate dynamics, the building of capacity and South-South cooperation, access to finance and finally strengthening communication, education, and

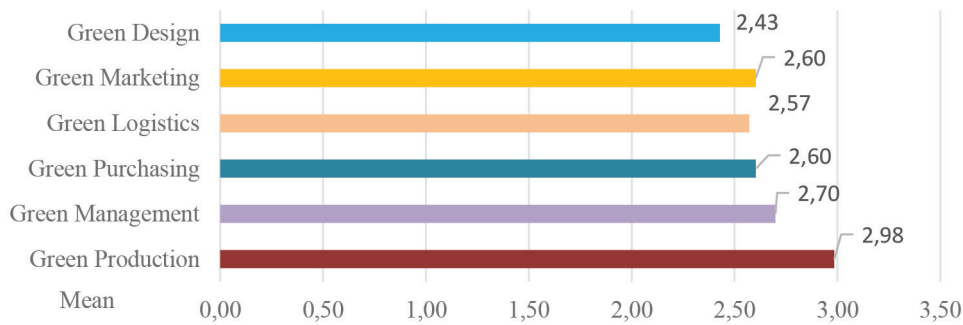


Figure 3. Mean distribution of adoption of GSCMP in six departments of the supply chain

awareness [101]. In India, In a study conducted by [16], the researchers employed a questionnaire with a response rate of 24.6% and discovered that green design was the least implemented practice among Indian automotive companies. They found a difference in the LA of GSCM between the six departments of the companies, which means that some departments are not involved in the GSCM approach to the same extent as others, which can lead to the creation of barriers to the continuous improvement of GSCM measures, in contrast, our findings demonstrated that departmental obstacles can be circumvented in our scenario, as the LA of GSCMP remains consistent throughout the entire life cycle of the company's products or services. Therefore, the resistance or delay in the GSCMP adoption is negligible if companies maintain the same implementation procedure based on the homogeneity of the application level and coordination between all the companies' departments. The results showed a uniform distribution and modest implementation of the GSCMP in all the company departments. This outcome arose due to the limited pressure exerted on Moroccan companies to consider the environmental aspects of these activities. According to [102] their research substantiated that in countries with strict green laws, regulations play a pivotal role as the primary influential factor in determining the LA of GSCMP. They affirmed that the Japanese industry is more aware of environmental regulations and adopts GSCM practices at a higher rate than the Chinese industry because Japan possesses a more robust set of green laws compared to China.

According to Figure 4, the model supports two factors having the highest impact on the LA of GSCMP (EAEP and TMC). The presence of EARP In our final model is consistent whit the results shown by [103]. They investigated the difference between

three groups of GSCM users (early adopters, Followers, and Laggards). They found that the first group had a higher LA of GSCMP than the other groups. They also achieved the highest level of improvement across all outputs (environmental, economic, operational, and GSCM-related).

Developing GSCM is a step-by-step process requiring a significant investment in time, experience, and resources. Those who establish the early decision to go green take the time to learn about green metrics and develop strategy training, outreach, and collaboration. In this way, they can gain valuable experience and knowledge that they can use over time to refine their green strategy. In addition, companies that adopt green activities early on can benefit from government incentives and subsidies designed to encourage sustainable practices. These incentives can help offset the initial investment required to implement a GSCM approach and make green practices adoption more financially affordable for businesses. Benefits of early adoption of green activities in companies include improved competitiveness, lower costs, better reputation, valuable experience and knowledge, and access to government incentives and subsidies. It can also contribute to the country's sustainable development goals and help address global environmental challenges.

Environmental regulations are insignificant on the LA of GSCMP for Moroccan companies because the green approach is still voluntary for most industrial activities. The comparison between national Environmental and Social (E&S) risk management systems and the Mondial Bank (E&S) framework highlights many areas where national systems need strengthening on environmental issues, both at the regulatory and institutional levels, to achieve the level required by the environmental and social frameworks [104]. If ecological regulations covered all industrial activities,

they would have become the highest factor for adopting GSCM practices. It is the case in countries with stricter environmental regulations. As shown in [2], [8], [77] work, regulation is the most significant factor in GSCMP adoption.

Furthermore, in a comparative analysis of environmental regulations in the context of sustainable construction between France and Morocco, [105] emphasized the need to strengthen the labelling approach, transition from voluntary practices to mandatory measures, and establish effective control and monitoring mechanisms to ensure adherence to existing standards and regulations. In short, the strengthening of the labelling and certification approach must be accompanied by stricter regulations and greater awareness to ensure sustainable and environmentally sound construction. They concluded that Moroccan legislation on environmental protection in sustainable construction remains limited and insufficient and does not achieve the desired objectives.

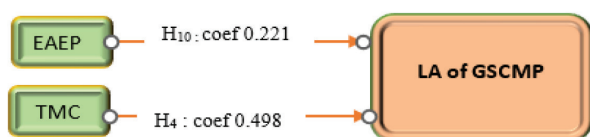


Figure 4. Operational model adopted

The three factors most frequently studied in the literature (activities sector, size, and age) are also insignificant for LA of GSCMP, in which small and medium enterprises, large enterprises, older enterprises, start-ups, and all sectors of the economy have the same opportunities to implement GSCM, there is no difference between these groups in terms of adoption of environmental practices, and this is good news for environmentalists because if environmental thinking is more focused on large companies than SMEs, it means that greening the supply chain is limited to a small percentage of companies since more than 90% of Moroccan companies are SMEs.

TMC is the main factor influencing the LA of GSCM (coef 0.498), in which the success of green supply chain management (GSCM) practices mainly depends on the TMC in the implementation process because the LA of GSCMP often requires significant changes in the company's operations, processes, and culture. According to the studies conducted by [15], [87], [88], it has been established that successful implementation of new business approaches or strategies, including those related to sustainable development, heavily relies on active participation of executives.

Moreover, TMC can be demonstrated through various actions, such as the allocation of resources and funding for GSCM initiatives, the integration of environmental considerations into the company's strategy and decision-making processes, and the development of partnerships and joint initiatives with suppliers and other stakeholders to improve environmental performance throughout the supply chain. In addition, TMC can also influence employee behaviour and attitudes toward environmental sustainability. When top management prioritizes environmental considerations and communicates the importance of GSCM practices, it creates a culture of green responsibility and motivates employees to adopt more sustainable practices in their work.

5.1. The practical's implications

The practical implications of our findings are as follows:

- Depending on our model, early adoption of environmental practices (EAEP) and top management commitment (TMC) are the two most influential factors on the adoption level of GSCM practices. Companies should prioritize these factors when implementing GSCM initiatives.
- In our case, departmental obstacles can be avoided since the level of adoption of GSCM practices is homogeneous throughout the company's product or service life cycle. Therefore, companies can minimize resistance or delays in GSCM adoption by maintaining a consistent implementation process based on the homogeneity of application levels and coordination between all departments.
- Our results indicate a uniform distribution and modest implementation of GSCM practices across all the company departments. The main reason behind this is the absence of regulatory pressure on Moroccan companies, compelling them to integrate environmental considerations into their operations.

Based on these implications, companies that want to improve their GSCM should focus on the early adoption of environmental initiatives and gaining commitment from senior management. Additionally, they need to ensure consistent coordination and implementation across departments and take advantage of the absence of stringent regulatory requirements that could hinder the smooth adoption of tasks imposed on companies.

5.2. Theoretical contributions

Several studies have been done in the literature on integrating environmental aspects into supply chain management. A literature review conducted by [106] identified 27 barriers and 41 drivers of green logistics. Similarly, [107] developed a questionnaire to assess motivation and obstacles related to sustainable supply chains in Morocco. For his part, [100] examined the correlation between the GSCM practices implementation and organizational performance. However, researchers have not adequately covered the factors that influence the adoption of GSCM practices.

Our research has made significant contributions from a theoretical perspective. Firstly, we conducted an empirical study to identify the various factors that influence the adoption of GSCM practices within Moroccan companies, which is an area that has received limited exploration thus far. Secondly, we specifically focused on the environmental aspect when developing our questionnaire and list of factors, making them applicable to companies beyond the borders of Morocco. It is worth noting that confusion often arises in the international literature regarding the distinction between GSCM and SSCM practices. However, our research exclusively concentrates on the environmental dimension and does not encompass the social aspect, which is a fundamental element of SSCM but not GSCM.

Our study can act as a reference point for researchers examining the implementation of GSCM in countries lacking stringent environmental regulatory laws. It offers valuable insights into the factors that motivate companies, not subject to rigorous regulatory pressures to adopt GSCM practices.

6. Conclusions

The environmental component is always at the global discussion centre and cannot be separated from other vital elements such as nutrition, health, and security. Industries in different sectors contribute to environmental pollution. The empirical studies on the factors that affect the LA of GSCMPs are the highly elaborated topics. We used a questionnaire-based survey to define the relationship between the LA of GSCMPs in Moroccan companies and ten sensitivity factors (SZ, SA, AG, AEP, EAEP, RGL, HBE, SEF, TEE, and TMC). From the literature review, we established ten research hypotheses describing the relationship between dependent and

independent variables. To explain the significance of the different constructs studied in this work, we used descriptive statistics, and to test the hypotheses, we used the multiple linear regression method. Our results suggest that companies emphasizing early adoption are more likely to adopt GSCM practices. The significance of early adoption of environmental practices refers to the company's willingness to adopt green practices before they become mandatory. This study suggests that all companies, regardless of size, age, or activities of operations, can adopt GSCM practices and contribute to environmental sustainability. Top management involvement and commitment are critical factors for the implementation success of GSCMP in companies. Therefore, companies must prioritize the commitment of top management when implementing GSCM practices to achieve the desired results.

In future research, we will test the relationship between the influencing factors and the activities of each component of GSCM: green design, green purchasing, green manufacturing, green logistics, green marketing, and green management. This will allow us to know the factors that influence the adoption of each component separately. Moreover, it will allow us to complete our operational model to have a complete vision of the factors that influence the LA of GSCMPs for each stage in the cycle of product/service life.

In a study investigating the relationship between variables, considering the phenomenon of moderation will strengthen the quality of the results, therefore, we will view it as a limitation in our current undertaking that can be rectified in forthcoming ventures. Moreover, statistical standards suggest that the sample is sufficient, but conducting a study with a larger sample size would yield statistically robust findings. Considering that a significant proportion of Moroccan businesses fall under the category of small and medium-sized enterprises, it would have been preferable to focus this study specifically on this enterprise type. However, since the GSCM approach is new to the Moroccan market, we decided to generalize the study to all sizes of companies and perhaps specialize in GSCM in SMEs in a future study.

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Annex 1 – Survey Questionnaire

I. Basic Company Information

a) Company Name

Your answer.....

b) Job position

Your answer.....

c) Seniority in the function (Please tick one answer)

- Beginner
 Experimented
 Expert

d) Size of company (Please tick one answer)

- Big organization
 SME
 Other

e) the business sector of the company

Your answer.....

f) Age of company

Your answer.....

II. Section A. General questions on environmental issues

a) Do environmental issues feature in your company's strategic decisions? (Please tick one answer)

- Yes Do not know No

b) How long have you taken environmental issues into account in your company's strategic decisions?

(Please tick one answer).

- for less than a year
 For one to three years
 For three to five years
 For more than five years
 Do not know

c) Please select the factors that influence the level of adoption of GSCM practices in your organization

(multiple choice answer)

- Regulations
 Training and Education of Employee
 Human Behavior of Employees
 Top management commitment

III. Section B. Assessment of the status of implementation of green practices

Please indicate to what extent you consider the following green supply chain practices in your organization (Question a- Question f). Where (5 = successfully implemented, 4 = initiated implementation, 3 = currently under consideration, 2 = planning, 1= not under consideration). (Please check ONE answer in each line).

a) To green the supply chain, please indicate the status of the following green design practices in your organization

Implementing green design practices in your organization	Ranking				
	1	2	3	4	5
1. Design for recycling	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Product life cycle analysis respecting environmental principles	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. substitution of dangerous and polluting materials by other safe and clean ones	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

b) To green the supply chain, please indicate the status of the following green procurement practices in your organization

Implementing green purchasing practices in your organization	Ranking				
	1	2	3	4	5
1. purchasing environmentally friendly products (recyclable content, non-toxic etc.)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. The cooperation with suppliers has an environmental management system	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Environmental auditing of suppliers/vendors'	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

c) To green the supply chain, please indicate the status of the following green production practices in your organization

Implementing green production practices in your organization	Ranking				
	1	2	3	4	5
1. Reduction in energy consumption	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Decreasing Air Emissions, Liquid and Solid Waste	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Utilisation of Cleaner Technology	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

d) To green the supply chain, please indicate the status of the following green management practices in your organization

Implementation green management practices in your organization	Ranking				
	1	2	3	4	5
1. Obtaining certification to ISO: 14001 or other EMS within the organisation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Environmental compliance & auditing programs	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Suggestion box to improve the environmental situation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

e) To green the supply chain, please indicate the status of the following green marketing practices in your organization

Implementing green marketing practices in your organization	Ranking				
	1	2	3	4	5
1. Use of green packing of the products	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Sale of scrap & used material	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Regular voluntary information on management to customers and institutions	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

f) To green the supply chain, please indicate the status of the following green logistics practices in your organization

Implementing green logistics practices in your organization Ranking	Ranking				
	1	2	3	4	5
1. Use of environmentally friendly transportation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Transport flow optimization	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Refurbishment of returned components or products	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>