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FACTORS AFFECTING THE IMPLEMENTATION OF GREEN SUPPLY CHAIN MANAGEMENT: POLICY IMPLICATIONS FOR ANIMAL FEED MANUFACTURING ENTERPRISES IN HANOI

FATORES QUE AFETAM A IMPLEMENTAÇÃO DA GESTÃO DA CADEIA DE SUPRIMENTOS VERDE: IMPLICAÇÕES POLÍTICAS PARA EMPRESAS DE FABRICAÇÃO DE RAÇÃO ANIMAL EM HANÓI

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Hoang Thi Thu Trang*
*University of Labour and Social Affairs, Hanoi, Vietnam
tranghtt.tlkt@ulsa.edu.vn

Le Thi Thu Trang**
**Trade Union University, Hanoi, Vietnam
trangltt@dhcd.edu.vn

Le Thanh Ha***
***Faculty of International Finance, Academy of Finance, Vietnam
lethanhha@hvtc.edu.vn

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Abstract
In the context of increasing requirements for environmental protection, biosecurity, and sustainable development in agriculture, the implementation of green supply chain management has become an important strategic orientation for animal feed manufacturing enterprises. However, the extent to which green supply chain practices are adopted in this sector in Vietnam remains uneven and is influenced by various factors. This study aims to identify and analyze the factors affecting the implementation of green supply chain management among animal feed manufacturing enterprises located in Hanoi. Based on a review of previous studies and the theoretical framework of green supply chain management, the study proposes a research model comprising key groups of factors, including regulatory and environmental pressures, pressures from customers and supply chain partners, top management commitment, and firms' internal capabilities. Research data were collected through a survey of 31 animal feed manufacturing enterprises operating in Hanoi and were analyzed using SPSS 26. The empirical results indicate that five factors have a positive impact on the implementation of green supply chain management. Based on these findings, the study proposes managerial and policy implications to promote the adoption of green supply chain management in the animal

Resumo
No contexto das crescentes exigências de proteção ambiental, biossegurança e desenvolvimento sustentável na agricultura, a implementação da gestão da cadeia de suprimentos verde tornou-se uma importante orientação estratégica para as empresas de fabricação de ração animal. No entanto, o grau de adoção de práticas de cadeia de suprimentos verde nesse setor no Vietnã permanece desigual e é influenciado por diversos fatores. Este estudo visa identificar e analisar os fatores que afetam a implementação da gestão da cadeia de suprimentos verde entre empresas de fabricação de ração animal localizadas em Hanói. Com base em uma revisão de estudos anteriores e no arcabouço teórico da gestão da cadeia de suprimentos verde, o estudo propõe um modelo de pesquisa composto por grupos-chave de fatores, incluindo pressões regulatórias e ambientais, pressões de clientes e parceiros da cadeia de suprimentos, comprometimento da alta administração e capacidades internas das empresas. Os dados da pesquisa foram coletados por meio de um levantamento com 31 empresas de fabricação de ração animal que operam em Hanói e analisados utilizando o SPSS 26. Os resultados empíricos indicam que cinco fatores têm um impacto positivo na implementação da gestão da cadeia de suprimentos verde. Com base nessas descobertas, o estudo propõe implicações

feed manufacturing industry toward sustainable development.

Keywords: Green Supply Chain Management. Animal Feed Manufacturing Enterprises. Sustainable Development.

gerenciais e políticas para promover a adoção da gestão da cadeia de suprimentos verde na indústria de fabricação de ração animal rumo ao desenvolvimento sustentável.

Palavras-chave: *Gestão da Cadeia de Suprimentos Verde. Empresas de Fabricação de Ração Animal. Desenvolvimento Sustentável.*

1 INTRODUCTION

In the context of continuous global economic growth, issues related to environmental pollution and resource depletion have become increasingly severe, posing significant challenges to traditional growth models. Faced with global pressures associated with energy security, water scarcity, and climate change, enterprises implementing green supply chain management are required not only to comply with environmental, health, and safety regulations, standards, and enforcement mechanisms at national, regional, and international levels, but also to proactively establish and monitor environmental standards for suppliers and supply chain partners. The effective implementation of these standards requires strong commitment and coordinated efforts, both internally within firms and across the entire network of supply chain stakeholders.

In this regard, the implementation of green supply chain management is considered one of the most effective solutions for enhancing environmental protection, promoting efficient resource utilization, and advancing sustainable development among manufacturing enterprises. By integrating environmental considerations into procurement, production, and distribution activities, green supply chain management not only helps mitigate negative environmental impacts but also enhances corporate reputation, strengthens competitive advantage, and improves firms' ability to meet evolving market requirements.

According to the Ministry of Agriculture and Rural Development (MARD), Vietnam is currently one of the countries with a highly developed pig farming sector worldwide, contributing a significant share to the value added of the agricultural sector and playing a crucial role in the national strategy for rural economic development. However, the ongoing transition from small-scale, household-based livestock production to large-scale, concentrated farming systems has generated substantial challenges related to environmental pollution and greenhouse gas emissions, particularly as Vietnam

deepens its integration into international commitments on environmental protection and sustainable development. In response to these challenges, the Livestock Development Strategy for the period 2020–2030, with a vision to 2045, promulgated under Decision No. 1520/QĐ-TTg of the Prime Minister, clearly emphasizes the development of the livestock sector toward a green, clean, and sustainable orientation, closely linked to strengthened environmental management and improved supply chain efficiency.

Against this backdrop, this study focuses on identifying and analyzing the factors affecting the implementation of green supply chain management in animal feed manufacturing enterprises located in Hanoi. The findings aim to provide a scientific basis for proposing appropriate managerial and policy solutions to promote the sustainable development of the livestock sector in the coming period.

2 LITERATURE REVIEW

Previous studies on Green Supply Chain Management (GSCM) in manufacturing firms indicate that the implementation of GSCM results from the combined effects of multiple groups of factors, which can generally be classified into external environmental pressures and internal organizational capabilities and motivations. From an external perspective, numerous studies have confirmed that institutional pressures, particularly environmental regulations and standards imposed by governments, play a critical role in motivating firms to integrate environmental considerations into their supply chain activities (Zhu & Sarkis, 2007). In addition, increasingly stringent requirements from customers and supply chain partners—especially within global value chains—compel firms to adopt environmentally friendly production and supply practices in order to maintain market access.

Beyond institutional and market pressures, competitive pressure and societal expectations regarding corporate environmental responsibility have intensified in the context of globalization and international economic integration, further encouraging firms to shift from traditional supply chain management models toward green supply chain practices (Eltayeb *et al*., 2011). These pressures are not only coercive in nature but also generate normative and cognitive motivations that shape firms' long-term strategic orientations.

Conversely, a substantial body of literature emphasizes the decisive role of internal organizational factors in translating external pressures into actual GSCM practices. Among these, top management commitment and support are widely regarded as prerequisite conditions that determine both the extent and effectiveness of GSCM implementation. Moreover, factors such as financial resources, technological capability, human resource quality and awareness, as well as internal environmental management systems, have been empirically shown to exert a positive influence on firms' ability to adopt and sustain green supply chain practices (Micheli *et al*., 2020).

In the Vietnamese context, recent studies have begun to examine the determinants of GSCM implementation within specific industries. Hang.T.T.T (2022) demonstrates that green practices and environmental collaboration with suppliers and customers have direct positive effects on environmental and social performance, while indirectly improving firms' economic performance. Similarly, Dung. T.D (2023) finds that firm commitment, social network relationships, and government support exert positive and reinforcing effects on the adoption of green supply chain management practices, thereby highlighting the combined role of internal drivers and institutional pressures in Vietnam.

Despite the valuable theoretical insights and empirical evidence provided by both international and domestic studies, several research gaps remain. *First*, the majority of prior research has focused on industrial manufacturing sectors or large-scale enterprises, whereas industry-specific studies, particularly those addressing animal feed manufacturing enterprises—which are closely linked to agricultural value chains and subject to distinct environmental pressures—remain limited. *Second*, many studies primarily examine the direct effects of external and internal factors on GSCM implementation, while the indirect mechanisms, especially the mediating roles of top management commitment and internal capabilities, have not been sufficiently tested in emerging economies such as Vietnam. *Third*, in the context of Vietnam's ongoing agricultural restructuring and commitments to sustainable development and emission reduction, there is a lack of empirical research that closely integrates institutional frameworks, industry characteristics, and local conditions.

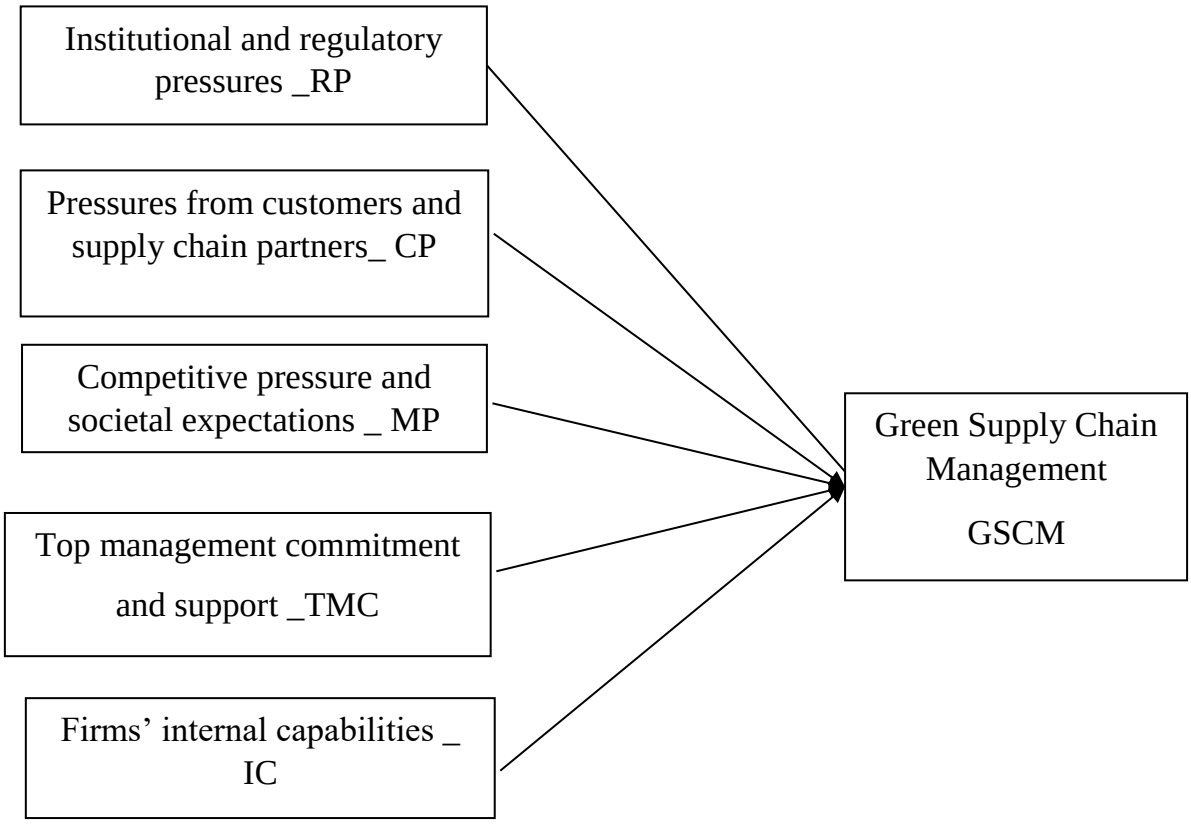
Addressing these gaps, the present study builds upon existing GSCM theoretical frameworks and proposes an integrated research model tailored to animal feed manufacturing enterprises. Specifically, external factors—including institutional pressure, customer and supply chain partner pressure, and competitive and social

pressure—are hypothesized to have positive effects on GSCM implementation. Furthermore, internal factors—particularly top management commitment and firms' internal capabilities (financial resources, technology, human resources, and environmental management systems)—are expected not only to exert direct effects but also to function as mediating mechanisms, facilitating the translation of external pressures into concrete green supply chain practices.

2.1 Research model and hypotheses

Diagram 1

Research model



Source: Compiled by author

Based on the theoretical review and prior empirical studies, the following hypotheses are proposed:

H1: Institutional pressure, including government environmental regulations and standards, has a positive effect on the implementation of green supply chain management in animal feed manufacturing enterprises.

H2: Pressure from customers and supply chain partners has a positive effect on the implementation of green supply chain management in animal feed manufacturing enterprises.

H3: Competitive pressure and societal expectations have a positive effect on the implementation of green supply chain management in animal feed manufacturing enterprises.

H4: Top management commitment and support have a positive effect on the implementation of green supply chain management in animal feed manufacturing enterprises.

H5: Firms' internal capabilities, including financial resources, technological capability, human resource quality, and environmental management systems, have a positive effect on the implementation of green supply chain management in animal feed manufacturing enterprises.

3 THEORETICAL BACKGROUND

3.1 Green supply chain management

Since the early 1990s, manufacturers have increasingly faced pressure to address environmental management issues within their supply chains. With the incorporation of the "green" dimension, the concept of a green supply chain has been defined as an approach aimed at minimizing the environmental impacts of a product or service throughout its entire life cycle. This life cycle encompasses all stages, from raw material sourcing, product design, manufacturing, and distribution to the delivery of the product to the final consumer, as well as the manner in which the product is used and managed thereafter.

According to Narasimhan and Carter (1998), a green supply chain represents an approach to minimizing the environmental impacts of a product or service across all stages of its life cycle. From this perspective, green supply chain management can be understood as a comprehensive process in which environmental considerations are integrated into every activity of the supply chain, including product design, sourcing of input materials, procurement, production, distribution to end users, and reverse logistics.

Therefore, green supply chain management is closely associated with the key links that constitute the supply chain, while systematically incorporating environmental considerations into these activities. As a result, the components of a green supply chain are often referred to using terms such as green design, green operations, green procurement, green inbound logistics, green outbound logistics, green strategy, and green manufacturing, reflecting the holistic integration of environmental concerns across the entire supply chain.

3.2 Theoretical framework

This study develops its theoretical framework by integrating key management and sustainability theories to explain the determinants of Green Supply Chain Management (GSCM) implementation in manufacturing firms.

First, Institutional Theory posits that firms are subject to coercive, normative, and mimetic pressures arising from regulatory bodies, industry norms, and competitive environments, which collectively drive the adoption of environmentally responsible practices across supply chains. Accordingly, regulatory requirements and environmental standards imposed by governments and industry associations are expected to exert significant influence on firms' GSCM practices.

Second, Stakeholder Theory emphasizes that firms must respond to the expectations and demands of various stakeholders, including customers, suppliers, and the wider society, in order to maintain legitimacy and long-term viability. Increasing stakeholder awareness of environmental issues intensifies pressures on firms to integrate green practices throughout their supply chains, particularly in industries closely linked to environmental and social sustainability.

Third, the Resource-Based View (RBV) provides a complementary perspective by highlighting the role of firm-specific resources and capabilities in enabling effective GSCM implementation. Internal factors such as top management commitment, technological capability, financial resources, and environmental management systems are viewed as strategic assets that allow firms to translate external pressures into proactive and sustained green supply chain practices.

By combining these theoretical perspectives, the proposed framework offers a comprehensive explanation of how external institutional and stakeholder pressures

interact with internal organizational capabilities to influence the extent of GSCM implementation in manufacturing firms.

4 RESEARCH METHODOLOGY

4.1 Qualitative research method

The qualitative research method was employed to explore and discuss the factors influencing the implementation of green supply chain management among animal feed manufacturing enterprises in Hanoi. Based on in-depth interviews with experts in the fields of supply chain management, environmental management, and the animal feed industry, the authors developed and refined the questionnaire used for the empirical survey. The finalized questionnaire was subsequently administered to animal feed manufacturing enterprises operating in Hanoi.

4.2 Quantitative research method

4.2.1 Data collection

According to Hair *et al*. (2010), the minimum sample size should be 50 observations, preferably 100, and the ratio of observations to measurement variables should be at least 5:1. The proposed research model comprises three groups of factors measured by 20 observed variables. Accordingly, the minimum required sample size is 100 observations. The study selected animal feed manufacturing enterprises located in Hanoi using a convenience sampling approach. Survey data were collected from 31 animal feed manufacturing enterprises operating in the study area.

4.2.2 Data processing and analysis

Survey data were screened in the subsequent stage to eliminate invalid questionnaires, including those with missing responses or inconsistent answers. A total of 142 valid questionnaires were retained for data analysis. The valid responses were coded and analyzed using SPSS software. The main analytical techniques applied in this

study included descriptive statistics, exploratory factor analysis (EFA), and regression analysis. Finally, the research results were interpreted and presented to address the research objectives and to support the discussion and conclusions of the study.

5 RESEARCH RESULTS

5.1 Reliability analysis using Cronbach's alpha

The reliability of the measurement scales was assessed using Cronbach's alpha. The results indicate that all Cronbach's alpha coefficients of the constructs are greater than or equal to 0.60, thereby satisfying the minimum threshold required for exploratory research and allowing the variables to be included in subsequent factor analysis. In addition, all corrected item–total correlation coefficients exceed the recommended cutoff value of 0.30, confirming that the observed variables are sufficiently correlated with their respective constructs. These findings demonstrate that the measurement scales exhibit acceptable internal consistency and statistical reliability for further analysis.

Table 1

Reliability Statistics

	Scale Mean if Item deleted	Scale Variance if Item deleted	Corrected Item – Tota Correlation	Cronbach's Alpha
RP	11.281	8.175	.731	.716
CP	11.151	8.212	.724	.712
MP	11.394	8.516	.718	.784
TMC	11.182	8.135	.735	.802
IC	11.650	8.401	.714	.723
GSCM	11.162	8.145	.768	.812

Source: Compiled by author

5.2 Exploratory Factor Analysis (EFA)

The suitability of the data for exploratory factor analysis was examined using the Kaiser–Meyer–Olkin (KMO) measure and Bartlett's Test of Sphericity. The results show that the KMO value is 0.762, which exceeds the recommended threshold of 0.50, indicating adequate sampling adequacy. In addition, the significance level of Bartlett's Test is 0.000, which is less than 0.05, confirming that the correlation matrix is not an

identity matrix and that the observed variables are sufficiently correlated for factor analysis.

The factor loadings of all observed variables are greater than 0.50, demonstrating strong convergent validity. Furthermore, the total variance explained by the extracted factors is 75.83%, exceeding the minimum acceptable level of 50%, while the Eigenvalue of the final extracted factor is 1.454, which is greater than the threshold value of 1. These results satisfy the standard criteria for conducting exploratory factor analysis.

Overall, the findings indicate that all measurement scales selected for the variables in the research model meet the required validity and reliability conditions and are therefore suitable for use in subsequent analyses.

Table 2

Rotated Component Matrixa

KMO	0.762
Sig.	0
Eigenvalue	1.454
Cumulative %	75.83

Source: Compiled by author

5.3 Regression analysis results

The regression analysis was conducted to examine the factors affecting the dependent variable, with five independent variables included in the model. The results indicate that the overall model fit is statistically significant, with a significance level of Sig. = 0.000, which is less than the threshold value of 0.05. This finding demonstrates that the set of independent variables included in the model is collectively capable of explaining variations in the dependent variable. Accordingly, the proposed regression model is considered appropriate and suitable for further interpretation and hypothesis testing.

Table 3

Coefficients[a]

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
Intercept	0.468	0.211		2.235	0.026		
RP	0.236	0.043	0.238	3.509	0.001	0.737	1.357
CP	0.124	0.038	0.184	3.245	0.001	0.679	1.473
MP	0.115	0.056	0.142	2.332	0.001	0.535	1.568
TMC	0.147	0.046	0.138	4.283	0.001	0.712	1.289
IC	0.128	0.052	0.187	2.453	0.015	0.602	1.641
R^2 =0.561, Adjusted R^2 = 0.678; F=43.566; Sig (F)= 0.000,							
a. Dependent Variable: GSCM							

Source: Compiled by author

The linear regression model representing the effects of the influencing factors on the development of green supply chain management in enterprises is specified as follows:

$$GSCM = 0.238*RP+ 0.184* CP+ 0.142*MP + 0.138*TMC+ 0.187*IC + \alpha$$

The results of the correlation matrix analysis indicate that the independent variables—RP, CP, MP, TMC, and IC—are correlated with the dependent variable GSCM, as well as with one another. Among these factors, regulatory pressure (RP) exhibits the strongest correlation with GSCM, with a correlation coefficient of 0.238.

The regression model and hypothesis testing results show that the adjusted R^2 value is 0.678, indicating that approximately 67.8% of the variance in green supply chain management implementation is explained by the independent variables included in the model. This result confirms that the proposed model demonstrates a satisfactory level of explanatory power. Furthermore, the model does not violate key regression assumptions, as the residuals are independent and all variance inflation factor (VIF) values are below 2, indicating the absence of multicollinearity. In addition, the significance levels (Sig.) of all independent variables are less than 0.05, confirming that each factor has a statistically significant relationship with the dependent variable.

Table 4

Results of Hypothesis Testing

Hypothesis	Expected Sign	Empirical Result	Conclusion
H1: Institutional pressure (government environmental regulations and standards) has a positive effect on the implementation of green supply chain management in animal feed manufacturing enterprises.	+	+	Accepted
H2: Pressure from customers and supply chain partners has a positive effect on the implementation of green supply chain management in animal feed manufacturing enterprises.	+	+	Accepted
H3: Competitive pressure and societal expectations have a positive effect on the implementation of green supply chain management in animal feed manufacturing enterprises.	+	+	Accepted
H4: Top management commitment and support have a positive effect on the implementation of green supply chain management in animal feed manufacturing enterprises	+	+	Accepted
H5: Firms' internal capabilities, including financial resources, technological capability, human resource quality, and environmental management systems, have a positive effect on the implementation of green supply chain management in animal feed manufacturing enterprises.	+	+	Accepted

Source: Compiled by author

5 CONCLUSION

The implementation of green supply chain management (GSCM) has been confirmed as an inevitable requirement for manufacturing enterprises in the context of increasing environmental pressures and the pursuit of sustainable development. At the same time, GSCM represents an important managerial tool for enhancing business performance while mitigating negative environmental impacts. Empirical evidence from animal feed manufacturing enterprises in Hanoi indicates that five groups of factors have a significant influence on the implementation of GSCM, including: (1) institutional pressure, (2) pressure from customers and supply chain partners, (3) competitive pressure and societal expectations, (4) top management commitment and support, and (5) firms' internal capabilities. Among these factors, institutional pressure exerts the strongest influence on the adoption of green supply chain practices.

Based on these findings, the study proposes several managerial and policy implications to strengthen the implementation of GSCM in animal feed manufacturing enterprises.

First, at the firm level, it is essential to enhance managerial awareness and commitment to green supply chain management, treating it as an integral component of long-term development strategies. In addition, firms should maintain and continuously improve their environmental management systems, allocate sufficient financial resources to green initiatives, and enhance the quality of human resources through training and skill development related to environmental management and supply chain operations.

Second, enterprises should proactively establish and strengthen their social networks, including relationships with suppliers, customers, industry associations, and local communities, in order to promote collaboration and information sharing regarding green supply chain practices. Such networks can facilitate learning, coordination, and the diffusion of environmentally responsible practices across the supply chain.

Third, firms are encouraged to effectively leverage government support through incentive policies, financial assistance, technology transfer programs, and technical guidance. These forms of support should be utilized flexibly and adapted to firms' specific operational conditions to maximize their effectiveness.

Finally, in the context of digital transformation, enterprises should intensify the application of digital technologies in the implementation of green supply chains. Digital solutions can enhance transparency in complying with environmental regulations, improve monitoring and traceability across supply chain activities, and contribute to more efficient resource utilization, thereby supporting sustainable development for future generations.

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Authors' Contribution

All authors contributed equally to the development of this article.

Data availability

All datasets relevant to this study's findings are fully available within the article.

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