Driving Factors of Green Supply Chain Management in Building Materials Enterprises

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Abstract. With the deterioration of the ecological environment and the improvement of consumers' green consciousness, the government and society put forward higher requirements for the green supply chain management of building materials enterprises. Some enterprises have already begun to implement green supply chain management, which brings pressure to other enterprises. Through the investigation of 245 building materials enterprises, this article establishes a model of the influence of external stakeholders on green supply chain management through the environmental awareness of internal executive and uses factor analysis and regression analysis to verify the research hypotheses. Empirical analysis results show that government regulation, consumer pressure and supplier and distributor pressure have significant positive effects on green supply chain management, and there exists intermediary effect of executives' environmental awareness between external stakeholders and enterprise green supply chain management. Thus, this article puts forward some suggestions on how to effectively improve the green supply chain management level of building materials enterprises from the perspective of executives, government and consumers.

1. Introduction

In recent years, researchers have used various management theories, such as resource-based theory, institutional theory, stakeholder theory, and high-order theory, to analyse the driving factors of enterprise green supply chain management (GSCM). The research on the driving factors of GSCM at the institutional organization level is mainly based on institutional theory and stakeholder theory, emphasizing the influence of external environment on organizational behaviour. Ye⁶ confirmed that competitors and regulations have a significant positive impact on green design. Through empirical analysis, Zhang⁷ believes that government support and promotion is a direct external driving factor for GSCM of steel companies. The research on the driving factors of GSCM at the individual level is mainly based on high-order theory, which believes that the environmental perception of executives affects their decision making and business performance. Gebauer⁸ rephrased that executives’ attention will regulate the transformation of corporate strategy. Peng⁹ found that the environmental awareness of executives has a significant positive impact on the implementation of environmental protection measures.

Although the implementation of GSCM will increase the cost of enterprises and will not bring profits in the short term, there are still many enterprises choose to upgrade their strategy. On the one hand, enterprises might be forced to implement GSCM under higher requirements of external stakeholders. On the other hand, it may take the initiative to this strategy due to the concern of executives about environmental issues. Therefore, this article discusses what factors lead to the...
implementation of GSCM and the specific path of their influence to explore how to obtain green competitive advantage for building materials enterprises.

2. Theoretical analysis and research hypothesis

2.1 Government regulation and GSCM
The government's influence on GSCM of building materials enterprises mainly includes mandatory regulation and incentive regulation. Scholars have different opinions on whether the government's mandatory regulation can promote enterprises to conduct environmental protection activities. Hsu and Tan[5] argue that standards, laws and process arrangements from government can put pressure on GSCM. However, Li's research shows that the effect of mandatory measures on GSCM is not significant[6]. The government mainly uses incentive means such as financial subsidies, taxation and technical support to improve GSCM. Shazmin[7] believes that the government's structural incentive policies, including technical support, municipal access and market guidance, can provide support for GSCM. In order to meet the requirements of government policies and obtain subsidies, enterprises may pay more attention to the green nature of products, which will be directly reflected in the supply chain management, including design, procurement, production, distribution and recycling.

Based on the above analysis, the following assumptions are put forward:
H1a: The government's mandatory regulation (GMR) has a positive impact on GSCM.
H1b: The government's incentive regulation (GIR) has a positive impact on GSCM.

2.2 Consumer pressure and GSCM
Numerous studies have shown that consumer pressure will promote GSCM. Wolf[8] pointed out that pressure from consumer green consumption will drive companies to transform their development strategies in response to consumer demand. In the actual consumption process, even though consumers have a high desire to purchase green building materials, they tend to be deterred from the environmental premiums contained in green products. The acceptance of consumers' premiums on green products directly affects the implementation of GSCM. If consumers are willing to obtain more green products through the transfer of higher commodity prices, they will encourage enterprises to increase their investment in environmental protection. In addition, the degree of cooperation between consumers and enterprises will also have a significant effect on GSCM. Consumers’ feedback and complaints for improving green products will release positive signals for companies to increase their greenness. Lao[9] believes that consumers with green consumer behaviour are more willing to cooperate with the company's green supply chain management activities.

Based on the above analysis, the following assumptions are put forward:
H2a: Consumers' green premium acceptance (GPA) has a positive impact on GSCM.
H2b: Consumers' green cooperation (CGC) has a positive impact on GSCM.

2.3 Supplier and distributor pressure and GSCM
The impact of pressure from suppliers and distributors on GSCM has also received widespread attention from researchers. The driving force of suppliers and distributors actually reflects the common needs of the entire supply chain for the improvement of GSCM. Jin[10] considers that the implementation of GSCM by suppliers and distributors can reduce the risk and difficulty of the green orientation of target enterprises, and thus enhance their enthusiasm for GSCM. The higher the environmental protection orientation of individual enterprises in the supply chain, the more the green management knowledge spills, and it can create good environment for GSCM of building materials companies. Besides, Yu[11] argues that the green management collaboration within the supply chain has a certain effect on the quality integration of the supply chain.

Based on the above analysis, the following assumptions are put forward:
H3a: Green knowledge sharing with suppliers and distributors (GKS) has a positive impact on GSCM.
H3b: Green management collaboration with suppliers and distributors (GMC) has a positive impact on GSCM.

2.4 Mediation effect of executive environmental awareness
Executives play an important role in driving the green management of building materials companies. When different companies face the same internal and external pressures, due to the different green attitudes of managers, unique green management behaviours can be produced. According to the logic of “environment-cognition-behaviour”, executives’ environmental awareness plays a mediating role between external stakeholders and GSCM. First, the stricter the government’s mandatory measures, the more it will cause executives to pay more attention to environmental issues. The government’s incentive measures will enhance the executives' understanding of environmental benefits, and thus transform the corporate green management strategy. Secondly, consumers’ environmental orientation can also stimulate corporate executives to pay attention to environmental issues, and actively improve the level of GSCM. Finally, suppliers and distributors are in the same supply chain as the target enterprises, and their ultimate goal is the same. The synergy of these enterprises is the premise and basis for GSCM.

Based on the above analysis, the following assumptions are put forward:
H4: Executives' environmental awareness (EEA) has a positive impact on GSCM.
H5a: Executives' environmental awareness plays a mediating role between GMR and GSCM.
H5b: Executives' environmental awareness plays a mediating role between GIR and GSCM.
H5c: Executives' environmental awareness plays a mediating role between GPA and GSCM.
H5d: Executives' environmental awareness plays a mediating role between CGC and GSCM.
H5e: Executives' environmental awareness plays a mediating role between GKS and GSCM.
H5f: Executives' environmental awareness plays a mediating role between GMC and GSCM.
Figure 1 shows the overall conceptual model of this article:

![Figure 1. Theoretical model of driving factors of GSCM in building materials enterprises.](image)

3. Methodology

3.1 Sample and data collection
Some of the sample data collection were distributed in the building materials associations in Hebei, Shanghai, Hunan and Guangdong and the others were distributed on the network through the questionnaire star platform. A total of 310 questionnaires were distributed and 245 valid questionnaires were returned. The effective rate of the questionnaire was 79%.

3.2 Variable Measurement
Dependent variable: Enterprise Green Supply Chain Management. This article draws on the research of Zhu\textsuperscript{[12]} (2009), Yi\textsuperscript{[13]} (2016) and Hsu\textsuperscript{[5]} (2013) to measure the green supply chain management of enterprises from four aspects: green design, green procurement, green production and green recycling. There are seven items in total.

Independent variable: Government Regulation. This paper draws on the research of Hsu\textsuperscript{[5]} (2013) and Li\textsuperscript{[6]} (2011) to measure government regulation from two dimensions: mandatory regulation and incentive regulation. There are six items in total. Consumer Pressure. This paper draws on the research of Sheng\textsuperscript{[14]} (2016) to measure consumer pressure from two dimensions: green premium acceptance and green cooperation. There are seven items in total. Supplier and Distributor Pressure. This paper draws on the research of Dai\textsuperscript{[15]} (2017) and Yu\textsuperscript{[11]} (2014) to measure supplier and distributor pressure from two dimensions: green knowledge sharing and green management collaboration. There are seven items in total.

Mediator variable: Executive Environmental Awareness. This article draws on the study of Gadenne\textsuperscript{[16]} (2009) to measure the environmental awareness of executives. There are three items.

Control variable: This paper selects the enterprise years and the nature of the enterprise as control variables. Control variables are measured by assigning dummy variables.

3.3 Reliability and validity analysis
It is generally believed that Cronhach's $\alpha$ value is above 0.7, which means good reliability. Tests on the scales show that all the dimensions of the construction satisfy this condition, and the CITC values of all items are greater than 0.4, indicating that the scales have high reliability. The validity test of the scale shows that the KMO values of each scale are greater than 0.7, and the Bartlett P values are less than 0.001. In addition, the principal component analysis method is used for factor analysis. The factors of each item are greater than 0.6, indicating that the scale has good construct validity.

4. Data and Results

4.1 Correlation analysis
In this article, the Pearson simple correlation coefficient method is used to measure the correlation of driving factors. The results are shown in Table 1.

|        | GMR | GIR | GPA | CGC | GKS | GMC | EEA | GSCM |
|--------|-----|-----|-----|-----|-----|-----|-----|------|
| GMR    | 1   |     |     |     |     |     |     |      |
| GIR    | .366** | 1   |     |     |     |     |     |      |
| GPA    | .422** | .383** | 1   |     |     |     |     |      |
| CGC    | .425** | .431** | .499** | 1   |     |     |     |      |
| GKS    | .477** | .491** | .405** | .475** | 1   |     |     |      |
| GMC    | .384** | .349** | .478** | .501** | .386** | 1   |     |      |
| EEA    | .446** | .343** | .525** | .397** | .419** | .385** | 1   |      |
| GSCM   | .551** | .506** | .529** | .626** | .620** | .542** | .431** | 1    |

Note: **P<0.01

4.2 Regression result
Table 2 shows mediation of executive environmental awareness to government regulation and GSCM. Model 2 examines the direct effect of government regulation on executives' environmental awareness...
(β=0.386, P<0.001; β=0.197, P<0.001). Model 4 incorporates the impact of government regulation on GSCM (β=0.349, P<0.001; β=0.257, P<0.001), which means hypotheses 1a, 1b are established. Model 5 demonstrates the impact of executive environmental awareness on GSCM (β=0.310, P<0.001), which means hypothesis 4 is established. Model 6 puts government regulation and executive environmental awareness into the regression model. The regression coefficients of the independent variables are 0.305 (P<0.001) and 0.234 (P<0.001), which are significantly lower than before, and the regression coefficient of executive environmental awareness was significant (β=0.310, P<0.001) in Model 5, indicating that executive environmental awareness has partial mediation on government regulation and GSCM. Hypotheses 5a, 5b are established.

Table 2. Mediation of executive environmental awareness to government regulation and GSCM.

| DV: Executive Environmental Awareness | DV: Enterprise Green Supply Chain Management |
|--------------------------------------|---------------------------------------------|
| Years                                | Model 1 | Model 2 | Model 3 | Model 4 | Model 5 | Model 6 |
|--------------------------------------|---------|---------|---------|---------|---------|---------|
| State-owned                          | 0.085   | -0.041  | 0.017   | -0.045  | 0.059   | -0.040  |
| Foreign                              | -0.186  | -0.109  | 0.085   | -0.044  | -0.070  | -0.031  |
| Joint Venture                        | -0.384  | -0.253  | -0.128  | -0.053  | -0.063  | -0.024  |
| GIR                                  | 0.386   |         | 0.349   |         | 0.305   |         |
| R²                                   | 0.054   | 0.256   | 0.035   | 0.041   | 0.196   | 0.435   |
| Adjusted R²                          | 0.038   | 0.237   | 0.049   | 0.042   | 0.179   | 0.418   |
| F Change                             | 11.365  | 13.657  | 1.207   | 28.378  | 11.639  | 26.014  |
| VIF Maximum                          | 1.053   | 1.222   | 1.053   | 1.122   | 1.084   | 1.344   |

Note: ***P<0.001; **P<0.01; *P<0.05; +P<0.1

Table 3 shows mediation of executive environmental awareness to consumer pressure and supplier and distributor pressure and GSCM. Model 2 examines the direct effect of consumer pressure on executives' environmental awareness (β=0.458, P<0.001; β=0.208, P<0.001). Model 4 incorporates the impact of consumer pressure on GSCM (β=0.245, P<0.001; β=0.409, P<0.001), which means hypotheses 2a, 2b are established. The regression coefficients of consumer pressure are 0.302 (P<0.001) and 0.393 (P<0.001) in Model 6, which are significantly lower than before, and the regression coefficient of executive environmental awareness was significant (β=0.310, P<0.001) in Model 5, indicating that executive environmental awareness has partial mediation on consumer pressure and GSCM. Hypotheses 5c, 5d are established.

Table 4 shows mediation of executive environmental awareness to supplier and distributor pressure and GSCM. Model 2 examines the direct effect of supplier and distributor pressure on executives' environmental awareness (β=0.341, P<0.001; β=0.251, P<0.001). Model 4 incorporates the impact of supplier and distributor pressure on GSCM (β=0.410, P<0.001; β=0.278, P<0.001), which means hypotheses 3a, 3b are established. Model 6 puts supplier and distributor pressure and executive environmental awareness into the regression model. The regression coefficients of the independent variables are 0.379 (P<0.001) and 0.255 (P<0.001), which are significantly lower than before, and the regression coefficient of executive environmental awareness was significant (β=0.310, P<0.001) in Model 5, indicating that executive environmental awareness has partial mediation on supplier and distributor pressure and GSCM. Hypotheses 5e, 5f are established.
5. Research conclusions and discussion

5.1 Research conclusions

5.1.1 The impact of external stakeholders on GSCM

The advent of the green economy has enabled companies to actively transform their development strategies. This study examines which external factors affect the implementation of GSCM. It can be seen that the dimensions of external stakeholder pressure have a significant positive impact on GSCM of building materials enterprises. Among them, government mandatory regulation, consumer green cooperation, green knowledge sharing and green management collaboration within the supply chain have a relatively large impact on GSCM.

5.1.2 Mediation effect of executive environmental awareness

The influence of external stakeholders on business management is an external factor. It is ultimately the enterprise executives who decide whether to upgrade the green supply chain management strategy. Therefore, executive environmental awareness acts as an intermediary between external stakeholders and GSCM. The mediation effect of executive environmental awareness on government mandatory regulation and GSCM (ab/c=0.177) is greater than its effect between incentive regulation and GSCM (ab/c=0.089). The mediation effect of executives environmental awareness on green premium acceptance and GSCM (ab/c=0.176) is greater than its effect between consumer green cooperation and GSCM (ab/c=0.039). While the mediation effect of executive environmental awareness on green knowledge sharing and GSCM (ab/c=0.076) is lower than its effect between green management collaboration and GSCM (ab/c=0.083). In summary, the mediating effect of executive environmental awareness is mainly reflected in government mandatory regulation, consumer green premium acceptance and GSCM.

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Table 4. Mediation of executive environmental awareness to supplier and distributor pressure and GSCM.

|                      | DV: Executive Environmental Awareness | DV: Enterprise Green Supply Chain Management |
|----------------------|---------------------------------------|---------------------------------------------|
|                      | Model 1 | Model 2 | Model 3 | Model 4 | Model 5 | Model 6 |
| Years               | .085 | .041 | .017 | .033 | .059 | .029 |
| State-owned         | -.186* | -.068 | .085 | .009 | -.070 | .015 |
| Foreign             | -.384** | -.211* | -.128* | .018 | -.063 | .037 |
| Joint Venture       | -.168 | -.074 | -.182 | -.010 | -.066 | -.003 |
| GKS                 | .341*** | .410*** | .379*** | .251*** | .310*** | .092* |
| GMC                 | .251*** | .278*** | .255*** |               |               | |
| EEA                 | .054 | .247 | .035 | .494 | .196 | .505 |
| F Change            | 3.435** | 18.599*** | 2.207* | 34.223*** | 11.639*** | 30.321*** |
| VIF Maximum         | 1.053 | 1.368 | 1.053 | 1.368 | 1.084 | 1.628 |

Note: ***P<0.001; **P<0.01; *P<0.05; +P<0.1
5.2 Management suggestion

Corporate executives are policy makers of enterprise strategy and have a direct impact on GSCM. First, executives need to be environmentally conscious. Research confirms that external stakeholders influence GSCM through the intermediary role of executives. Second, executives ought to strengthen the technological innovation of enterprises and reduce the green premium of products. Consumers' tolerance for green premium is limited. Therefore, senior executives should avoid cost crisis through technological innovation rather than cost transfer. Third, companies need to establish an interactive and cooperative mechanism with consumers. By cooperating with consumers and accepting feedback from consumers about products, enterprise can make their products more responsive to consumers' needs. Fourth, enterprises are supposed to strengthen management collaboration and knowledge sharing with other enterprises. Enterprises can conduct research activities with other enterprises to cultivate their ability to continuous learning and innovation. In addition, the establishment of effective communication channels can reduce business losses caused by information asymmetry.

The government has an important role in greening strategy upgrade of building materials enterprises. First, the government under the necessity of increasing the support of green subsidies for all aspects of GSCM. The current incentive policy focuses on support for green production. Future financial subsidies should comprehensively consider the role of other links in the green supply chain. In addition, the government should increase the post-examination of support projects to ensure that support funds and resources can be truly placed in GSCM.

Consumers are also important driving force for building materials companies to implement GSCM. Consumers' green environmental trends have a significant impact on GSCM. Therefore, consumers need to improve their environmental awareness and actively communicate with the company about product information. Consumers’ feedback and complaint will also release positive signals for companies to improve their environmental performance.

5.3 Research limitation

Taking the building materials industry as an example, this article summarizes the measurement indicators of driving factors for GSCM, carries out the test of relevant influences, and obtains some useful conclusions. However, due to the author's ability and cost constraints, the sample data volume of this study is limited. Although the final sample companies have a wide range of corporate traits, small-scale sample size may lead to the lack of universality in the research conclusions, more representative enterprise sample data can be selected for further testing.

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