Dependence on Supplier, Supplier Trust and Green Supplier Integration: The Moderating Role of Contract Management Difficulty

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Abstract: This study aims to investigate the impacts of dependence on supplier and supplier trust on green supplier integration, and the moderating role of contract management difficulty. In this study, we develop a dependence-trust-integration model based on resource dependence theory, social capital theory and transaction cost theory. We examine the hypothesized relationships using hierarchical regression analyses based on data collected from 187 Chinese firms. Our findings suggest that dependence on supplier has positive impacts on green supplier integration and supplier trust. Supplier trust partially mediates the relationship between dependence on supplier and green supplier integration. In addition, contract management difficulty negatively moderates the relationship between supplier trust and green supplier integration. This research contributes to the literature by offering empirical evidence concerning the indirect relationship between dependence on supplier and green supplier integration via supplier trust, and the trust-integration link depends on the level of contract management difficulty.

Keywords: green supplier integration; dependence on supplier; supplier trust; contract management difficulty

1. Introduction

Economic performance is generally a critical priority for firms in emerging countries [1]. However, the rapid economic development in these countries has produced negative influence on the eco-environment such as harmful gas emissions, toxic pollution and solid waste [2,3]. To establish a balance between economic performance and environmental performance, firms are beginning to integrate suppliers into their planning and operational activities to solve environmental problems jointly [4–10]. We define the extent to which the firm integrates its major supplier into joint problem-solving activities for reducing its negative influence on the natural environment as green supplier integration [6]. Previous studies have argued that green supplier integration helps the manufacturer to gain more information and resources which are conducive to both environmental and financial performance [2,6].

Although the influence of green supplier integration on performance outcomes has been widely studied [6,11], our understanding of how to improve the degree of green supplier integration is still limited. The major purpose of green supplier integration is to solve environmental problems jointly and reduce the adverse impacts of production and operational processes on the natural environment, which is different from supplier integration in previous studies [6,12]. In the process of green supplier integration, the manufacturer and its suppliers may depend on each other, and the importance of trust

becomes more prominent [13–15]. Thus, there is a need to investigate the impacts of dependence and trust on green supplier integration.

Drawing upon resource dependency theory [12], social capital theory [16] and transaction cost theory [17,18], we propose that dependence on supplier and supplier trust may play important roles in enhancing the degree of green supplier integration. As structural interdependence and an asymmetry of resource distribution exists in the supplier–manufacturer relationship, the manufacturer may depend on its suppliers [19]. Dependence on supplier is defined as the reliance of the manufacturer on the actions of its suppliers to achieve certain goals [20]. It reflects the importance of this relationship and bargaining power between the manufacturer and its suppliers [21]. In the relationship, distinct members often have different levels of dependence [22]. Although collaborating with suppliers brings benefits for the manufacturer [23,24], the higher level of dependence may result in uncertainties, relationship conflicts and opportunistic behaviors, which have a negative influence on collaboration performance [25–27]. Resource dependency theory suggests that the manufacturer needs to develop long-term and stable relationships with its suppliers in order to reduce the degree of dependence on suppliers [12,17].

Supplier trust is defined as the degree to which the manufacturer believes its major supplier is honest and trustworthy [28]. It reflects the confidence and willingness of the manufacturer to depend upon its suppliers [29]. According to social capital theory, supplier trust plays a crucial role in enhancing cooperation between the manufacturer and its suppliers as it decreases the uncertainty of suppliers' actions and opportunism [12,30]. In the supplier–manufacturer relationship, supplier trust and dependence on supplier exist simultaneously and they affect green supplier integration jointly [18]. Therefore, understanding the independent and joint effects of dependence on supplier and supplier trust on green supplier integration is important for practitioners to implement green supplier integration efficiently and effectively. However, few existing studies have simultaneously examined the influence of dependence on supplier and supplier trust on green supplier integration.

It is also important to understand the boundary conditions of supplier trust impacts on green supplier integration. As suggested by transaction cost theory, contract management difficulty reflects the costs and efforts required to manage the formal contract between the firm and its suppliers [31,32]. If a firm experiences contract management difficulties, it will turn to trust as an alternative approach of control [33]. In other words, supplier trust may be used to substitute for effective contract management. As a result, the link between supplier trust and green supplier integration will be stronger in the context of a higher level of contract management difficulty.

To address these research gaps, this research mainly addresses three questions. (1) Does dependence on supplier affect green supplier integration? (2) How does supplier trust mediate the relationship between dependence on supplier and green supplier integration? (3) How does contract management difficulty moderate the relationship between supplier trust and green supplier integration? The answers of these three questions contribute to green supply chain integration literature and provide managerial implications for improving the level of green supplier integration.

2. Research Hypotheses

This research examines the influence of dependence on supplier on green supplier integration, the mediating role of supplier trust, and the moderating role of contract management difficulty based on resource dependence theory, social capital theory and transaction cost theory. We show the conceptual model of this article in Figure 1.
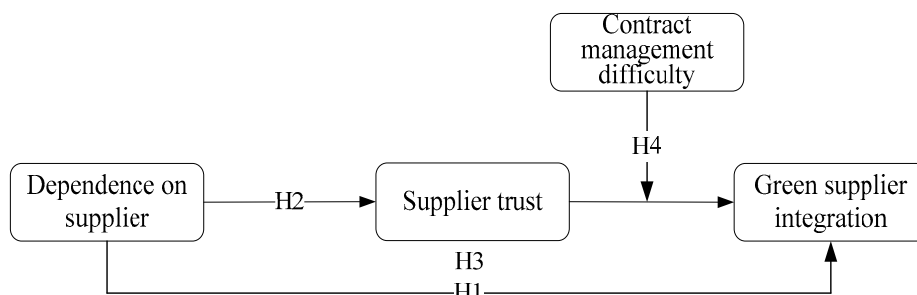
Figure 1. Conceptual model.

2.1. Dependence on Supplier and Green Supplier Integration

As suggested by resource dependence theory, once a supplier masters important resources (tangible and intangible) for dealing with environmental dynamics and uncertainties, the manufacturer may be dependent on this supplier [18]. As firms need to acquire information and knowledge from supply chain partners to enhance their capabilities and obtain competitive advantage, suppliers can be deemed as critical resources [34,35]. If the degree of dependence on a supplier is higher, it will be difficult for the manufacturer to gain valuable resources from its suppliers by developing an arm's length relationship [18]. In this case, establishing stable and long-term relationships may be a better choice for the manufacturer [35].

On the contrary, the manufacturer is not likely to build long-term relationships with its suppliers when the degree of dependence on suppliers is lower. On this occasion, the manufacturer and its suppliers may engage in opportunistic behaviors that are harmful to the relationship [12,36]. As a result, the manufacturer will be unwilling to establish long-term relationships with its suppliers. In sum, if the manufacturer is dependent on its suppliers, it is more likely to integrate suppliers into joint problem-solving activities. Thus, we propose the following hypothesis:

Hypothesis 1 (H1). *Dependence on suppliers has a positive impact on green supplier integration.*

2.2. Dependence on Supplier and Supplier Trust

Existing literature has suggested that dependence on a supplier has a positive impact on supplier trust [37]. From the perspective of transaction cost theory, supplier trust is conducive to the reduction of opportunistic behaviors [18]. If the manufacturer does not want to develop trust relationships with its suppliers, these suppliers may engage in opportunistic behaviors. Thus, the manufacturer tends to build trust with its suppliers in the context of higher level of dependence on supplier.

Furthermore, supplier trust offers a possible approach to settle the negative influences resulting from a higher level of dependence on a supplier [18]. When the manufacturer depends heavily on its suppliers, it is likely to build a trust relationship with suppliers to mitigate the possible influence of uncertainties and risks [12]. Thus, dependence on suppliers is proposed to enhance the level of supplier trust [38]. Accordingly, we hypothesize that:

Hypothesis 2 (H2). *Dependence on suppliers has a positive impact on supplier trust.*

2.3. The Mediating Role of Supplier Trust

Since the manufacturer depending on its suppliers needs support from these suppliers to reach its strategic goal and enhance performance, it will be difficult for this manufacturer to switch to other suppliers [33]. Thus, dependence on suppliers will push the manufacturer to implement green supplier integration [12,18,36]. However, dependence on suppliers may affect green supplier integration indirectly. This research proposes that dependence on suppliers influences green supplier integration through supplier trust.

Social capital theory suggests that supplier trust is important for enhancing the collaboration between the manufacturer and its suppliers by reducing the uncertainties and risks [12,30]. Thus, supplier trust may facilitate green supplier integration by building common values, sharing information and developing mutual understanding [39]. In this study, dependence on suppliers is proposed to improve the level of supplier trust, which, in turn facilitates green supplier integration [18]. Based on the above arguments, we hypothesize:

Hypothesis 3 (H3). *Supplier trust mediates the relationship between dependence on suppliers and green supplier integration.*

2.4. The Moderating Role of Contract Management Difficulty

Based on transaction cost theory, the goals between the manufacturer and its major supplier may be unmatched and the information between these two parties may be asymmetric [40,41]. Thus, there exist uncertainties and risks in this relationship [18]. The suppliers' interest may not always be aligned with that of the manufacturers [33]. In this case, the manufacturer will employ contractual devices to control the behaviors of its major supplier [33,42].

Previous studies have suggested incentive contracting to be a primary approach of controlling unexpected behaviors of suppliers [33]. However, sometimes the management costs of a formal contract are very high [43]. If managing the contract is costly, it will be difficult for the manufacturer to reduce suppliers' opportunistic behaviors. Thus, the manufacturer tends to use trust to manage its relationship with major supplier in the context of a higher level of contract management difficulty.

Moreover, the firm may adjust the degree of green supplier integration based on its perception on the level of contract management difficulty [44]. As a result, this study suggests that as the manufacturer has difficulty in effectively managing the contract, it will tend to use trust to maintain the relationship with its major supplier [33]. Supplier trust is likely to be considered as a substitution for effective contract management. We define contract management difficulty as the efforts and costs associated with effectively managing the formal contract of the supplier–manufacturer relationship. Hence, we hypothesize:

Hypothesis 4 (H4). *Contract management difficulty positively moderates the relationship between supplier trust and green supplier integration.*

3. Research Methods

3.1. Sampling and Data Collection

Data used in this research are collected from Chinese manufacturing companies. Since the degrees of economic development and marketization are distinct in different regions of China, we selected Guangdong, Jiangsu, Shandong, Shaanxi and Henan as the sample base to collect data. All these five provinces represent important manufacturing regions with a wide variety of supply chain activities. We then chose 600 manufacturing companies at random.

We contacted the selected firms by phone or emails to get their cooperation. If firms agreed to participate in our survey, we sent them a summary report after the survey. Among firms we contacted, 284 of them agreed to participate in this study. Three trained doctoral students were arranged to carry out the onsite survey. These doctoral students were trained about the research purpose, content of questionnaire, and communication skills. CEO/presidents, vice presidents or supply chain managers were identified as key informants as they are sufficiently knowledgeable to answer the survey questions in the questionnaire. In the cover letter of the questionnaire, we told the informants that if they were not familiar with the questions in the questionnaire, they ccould ask someone else familiar with the questions for help.

A total of 187 usable questionnaires were returned. The valid response rate of our survey was 31.2%. The responding firms covered a diverse variety of industries, such as electrical machinery

and equipment, communication and computer-related equipment, rubber and plastics, instruments and related products, and transport equipment. The characteristics of responding firms are shown in Table 1.

Since non-response bias is a major issue in empirical research, we employed several t-tests of the responding and non-responding firms to firm age and firm size [45]. The results indicate that the t-statistics are insignificant. Thus, non-response bias is not an issue in this study. Furthermore, we conducted t-tests on the early and late responses to all the variables in this research [22]. The results suggest no significant differences for all the variables. Hence, non-response bias is not a serious problem in this research. The results of t-tests are shown in Appendix A.

Table 1. Characteristics of the responding firms (*n* = 187).

	Frequency	Percentage
Industry		
Food, beverage and textile	14	7.5
Chemical and related products	8	4.3
Pharmaceutical and medical	8	4.3
Rubber and plastics	14	7.5
Non-metallic mineral products	11	5.9
Metal products	14	7.5
Machinery	12	6.4
Transport equipment	19	10.1
Electrical machinery and equipment	30	16.0
Communication and computer-related equipment	42	22.5
Instruments and related products	8	4.3
Others	7	3.7
Number of employees		
Less than 100	29	15.5
100–299	34	18.2
300–999	28	15.0
1000–1999	23	12.3
2000–4999	36	19.2
No less than 5000	37	19.8
Structure of ownership		
State-owned and collective enterprises	69	36.9
Private enterprises	73	39.0
Foreign-invested enterprises	45	24.1

3.2. Measures

The measurement items used in this article were adopted or adapted from existing research. We first developed the English version of the questionnaire and then translated it into Chinese by a scholar in operations and supply chain management. Another scholar then translated the Chinese version of the questionnaire back into English. We checked the translated English version against the original English version to ensure accuracy. We used the Chinese version in the formal survey.

At the pre-test stage, we sent the questionnaire to a sample of 10 firms. We visited these firms and conducted in-depth interviews with their CEOs, vice presidents or general managers after they had completed the questionnaire. According to their feedback, we modified the questionnaire to ensure the items were understandable and relevant to supply chain management practices in China.

Dependence on supplier. Dependence on supplier reflects the extent to which the firm needs to maintain the relationship with its major supplier to achieve its expected goals [46]. Dependence on supplier was measured using three items adapted from [46]. Sampled items include "If our relationship with the major supplier is discontinued, we would have had difficulty achieving our goals", and "It would have been difficult for us to replace the major supplier".

Supplier trust. Supplier trust refers to the degree to which a firm believes that its major supplier is honest and trustworthy [28]. We measured supplier trust with a five-item scale adapting from [47]. Sampled items included "We can count that this supplier's future decisions and actions will not adversely affect us", and "When it comes to things that are important to us, we can depend on this supplier's support".

Green supplier integration. In this study, we measured green supplier integration with a six-item scale adapted from [6,11]. Sampled items included "Developing a mutual understanding of responsibilities regarding environmental performance", and "Conducting joint planning to anticipate and resolve environmental-related problems".

Contract management difficulty. Contract management difficulty reflects the efforts and costs required by the manufacturing firm to develop and maintain the formal contract with its suppliers. Contract management difficulty was measured with three items adapted from [33]. Sampled items included "The costs associated with developing and maintaining our formal agreements with this supplier are significant", and "Ensuring that our contract adequately represents our evolving relationship with this supplier requires substantial resources".

Control variables. Previous studies suggested that some factors could exert an impact on green supplier integration [6,48]. Therefore, these factors were used as control variables in this study. Firm size was measured with the natural logarithm of the number of employees to mitigate the possible influence of univariate non-normalities [49]. Firm age was measured with the natural logarithm of the number of years operating in this region. We measured longevity of the relationship with the natural logarithm of the duration of the relationship with this supplier. Industry type was measured with a dummy variable (1 = highly polluting industries and 0 = otherwise). Highly polluting industry was defined according to "Guidance on Environmental Information Disclosure of Listed Companies" issued by Ministry of Environmental Protection. Based on [46], we measured competitive intensity using a four-item scale. Sampled items included "The business climate for the final product(s) is very competitive", and "Competition in this industry is cutthroat".

3.3. Reliability and Validity

We plotted the cumulative proportion of each variable against the cumulative proportion to check for the normality of the distribution. The results suggest that the variables in this study are approximately normally distributed. We also conducted an exploratory factor analysis (EFA) with principal component analysis and varimax rotation to confirm the unidimensionality of variables. The EFA results suggest five factors with eigenvalues higher than 1.0. Each item has higher factor loading on its intended construct, but lower factor loadings on the constructs it is not expected to measure. Therefore, the unidimensionality is satisfactory.

Results in Table 2 indicate that the Cronbach's α values range from 0.877 to 0.960, higher than the critical value of 0.80. These findings indicate that all the items are reliable [50]. The composite reliability (CR) values are also used to examine construct reliability [50]. As revealed in Table 2, the CR values for all of the variables are greater than 0.80, which further indicates that the measurements are reliable.

Table 2. Results of confirmatory factor analysis.

Construct	Item Code	Factor Loading	Cronbach α	CR	AVE
Competitive intensity	CI1	0.80	0.896	0.899	0.691
	CI2	0.76			
	CI3	0.96			
	CI4	0.78			
Dependence on supplier	DS1	0.86	0.952	0.953	0.836
	DS2	0.90			
	DS3	0.96			
	DS4	0.94			

Table 2. *Cont.*

Construct	Item Code	Factor Loading	Cronbach α	CR	AVE
Supplier trust	ST1	0.88			
	ST2	0.94			
	ST3	0.92	0.943	0.944	0.772
	ST4	0.88			
	ST5	0.76			
Green supplier integration	GSI1	0.90			
	GSI2	0.87			
	GSI3	0.81	0.960	0.960	0.800
	GSI4	0.94			
	GSI5	0.94			
	GSI6	0.90			
Contract management difficulty	CMD1	0.78			
	CMD2	0.91	0.877	0.879	0.708
	CMD3	0.83			

Content validity was ensured through reviewing existing literature widely and carefully. Confirmatory factor analysis (CFA) was used to assess the convergent validity. We linked each item with its expected construct and freely estimated the covariance matrix between constructs in the CFA model. The model fit indices are $\chi^2(199) = 321.23$, RMSEA = 0.057, NNFI = 0.98, CFI = 0.98 and SRMR = 0.045, which are considered to be acceptable. Moreover, all of the factor loadings are higher than 0.70, and all of the t-values are greater than 2.0. These results also provide evidence for convergent validity. All of the average variance extracted (AVE) values are greater than 0.50, which further ensured convergent validity.

We compared the square root of AVE value for each variable with the correlation between that variable and the other variables to examine the discriminant validity. As shown in Table 3, the square root of each AVE value is higher than the correlation between that variable and other four variables, indicating that the discriminant validity is acceptable [50].

Table 3. Means, standard deviations, and correlations.

Constructs	Mean	S.D.	1	2	3	4	5	6	7	8	9
1. Firm size	6.635	1.758	-								
2. Firm age	2.575	0.733	0.427 **	-							
3. Longevity of relationship	1.688	0.609	0.234 **	0.373 ***	-						
4. Industry type	0.369	0.484	−0.063	−0.057	0.082	-					
5. Competitive intensity	5.377	1.235	−0.252 ***	−0.097	−0.083	−0.037	0.831				
6. Dependence on supplier	5.154	1.248	−0.131	−0.161 *	−0.101	0.075	0.080	0.914			
7. Supplier trust	5.338	1.110	−0.076	−0.008	−0.027	−0.067	0.070	0.503 ***	0.879		
8. Green supplier integration	4.853	1.180	−0.129	−0.022	0.081	0.100	0.072	0.397 ***	0.300 ***	0.894	
9. Contract management difficulty	3.809	1.293	0.073	0.020	−0.039	0.032	−0.013	0.138	−0.044	0.109	0.842

Note: * $\alpha = 0.05$; ** $\alpha = 0.01$; *** $\alpha = 0.001$; square root of AVE value is on the diagonal.

3.4. Evaluating Common Method Variance

Since the survey data were sourced from a single respondent in each firm, the findings of this study may suffer from common method variance (CMV) [51]. To check for the potential influence of CMV, this study identified two respondents in 10 of the sampled companies and performed independent interviews with them based on the same questionnaire. We selected these 10 companies according to their geographic proximity to the university. The results of reliability test revealed a high degree of internal consistency suggesting CMV is not an issue in this research.

To evaluate the possible influence of CMV, a Harman's one-factor test was conducted [51]. The results show five factors with eigenvalues higher than 1.0, explaining 82.6% of the total variance. The first factor only explains 23.0% of the variance, which is not the majority of the total variance. As a result, CMV is not serious in this research. We also performed CFA for Harman's one-factor test to check for the potential CMV [51]. The fit indices of Harman's one-factor model are not satisfactory:

$\chi^2 = 2718.75$ with 209 degrees of freedom (compared with $\chi^2 = 321.23$ and d.f. = 199 for the CFA model). Thus, several distinct factors should exist, which suggests that CMV is not an issue.

To further evaluate the possible influence of CMV, we tested a measurement model including only the traits, and one adding a method factor [52]. After adding the method factor, the model fit indices were only marginally improved. In addition, the factor loadings of items are still significant suggesting that the measurement model was robust. Hence, the influence of CMV is not serious.

4. Analysis Results

In this article, we performed hierarchical regression analyses to test the proposed relationships. Before forming the interaction term, independent variable and moderating variable were mean-centered to mitigate the potential influence of multi-collinearity [53]. This research shows the regression analyses results in Table 4.

Table 4. Regression analyses results.

Variables	Supplier Trust			Green Supplier Integration			
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Control variables							
Firm size	−0.078	−0.050	−0.139 †	−0.118	−0.116	−0.111	−0.140 †
Firm age	0.030	0.086	0.007	0.051	−0.002	0.039	0.007
Longevity of relationship	−0.010	0.016	0.108	0.128 †	0.111	0.125 †	0.122
Industry type	−0.068	−0.105	0.084	0.056	0.105	0.070	0.075
Competitive intensity	0.050	0.022	0.050	0.029	0.035	0.026	0.040
Independent variable							
Dependence on supplier (DS)		0.518 ***		0.396 ***		0.347 ***	
Mediators							
Supplier trust					0.299 ***	0.194 **	0.275 ***
Moderator							
Contract management difficulty (CMD)							0.156 *
Interaction terms							
DS × CMD							−0.167 *
R square	0.014	0.272	0.039	0.189	0.127	0.224	0.170
R square change		0.258		0.150	0.098	0.035	0.043
F(d, f) change		63.709 ***		33.476 ***	18.159 ***	8.663 **	4.658 *

Note: † $p < 0.10$; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$ (two-tailed).

H1 proposes that dependence on supplier has a positive impact on green supplier integration. Results in Table 4 (Model 4) suggests that dependence on supplier is positively and significantly related to green supplier integration ($\beta = 0.396$, $p < 0.001$). Thus, this finding provides empirical support for H1. This indicates that if a firm depends on its suppliers it is more likely to integrate its suppliers into joint planning for environmental management and environmental solutions.

H2 hypothesizes that dependence on supplier has a positive impact on supplier trust. Results in Table 4 (Model 2) reveal that dependence on supplier is positively and significantly related to supplier trust ($\beta = 0.518$, $p < 0.001$). Thus, H2 is empirically supported. This results suggest that the firm that depends on its suppliers is more likely to develop trust with its suppliers.

This study conducts a three-step regression analysis to examine the mediating effect of supplier trust [53]. First, the mediating variable (supplier trust) is regressed on the independent variable (dependence on supplier). Second, the dependent variable (green supplier integration) is regressed on the independent variable. Third, the dependent variable is regressed on the independent and mediating variables simultaneously. A mediating effect exists if the independent variable is significantly related to the mediating and dependent variables, and the mediating variable is significantly related to the dependent variable [54]. There is a full mediating effect if the impact of the independent variable on the dependent variable becomes insignificant after controlling for the impact of the mediating variable. There is a partial mediating effect if the significant impact of independent variable on dependent

variable becomes weaker after controlling for the impact of mediating variable. The results of the stepwise regression analyses are depicted in Table 4.

In Model 2, dependence on supplier is significantly related to supplier trust ($\beta = 0.518$, $p < 0.001$). In Model 4, dependence on supplier is significantly related to green supplier integration ($\beta = 0.396$, $p < 0.001$). After controlling for the impact of supplier trust ($\beta = 0.299$, $p < 0.001$), the relationship between dependence on supplier and green supplier integration becomes weaker ($\beta = 0.347$, $p < 0.001$). These findings indicate that supplier trust partially mediates the relationship between dependence on supplier and green supplier integration. Thus, H3 is empirically supported.

In H4, we predict that the link between supplier trust and green supplier integration will be strengthened when the level of contract management difficulty is higher. Model 7 in Table 4 indicates that the interaction between supplier trust and contract management difficulty is negatively related to green supplier integration ($\beta = -0.167$, $p < 0.05$). Thus, H4 is rejected. To better understand the moderating effect of contract management difficulty, we follow [53] and decompose the interaction term. Specifically, we perform simple slope tests and depict the significant moderating effect in Figure 2. We split the variable of contract management difficulty into two groups—low (one standard deviation below the mean) and high (one standard deviation above the mean)—and assess the impact of supplier trust on green supplier integration for both levels. As shown in Figure 2, the impact of supplier trust on green supplier integration is lower at high level of contract management difficulty compared with low level of contract management difficulty. These results further indicate that contract management difficulty negatively moderates the relationship between supplier trust and green supplier integration.
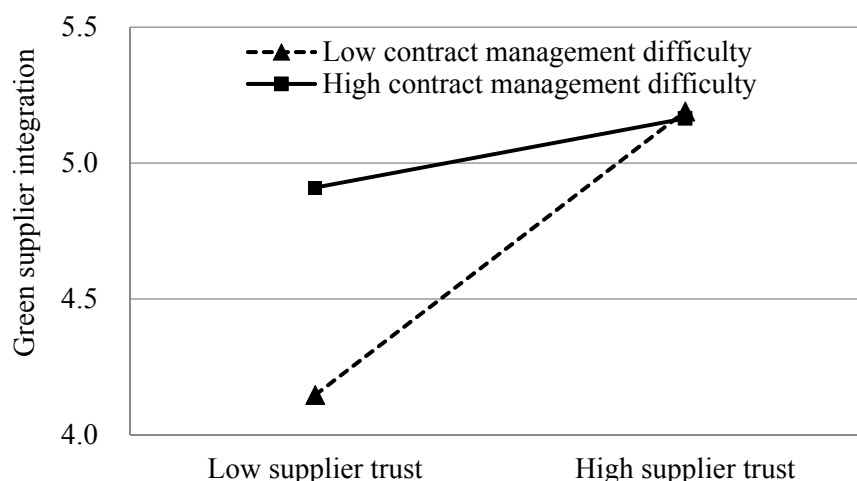
Figure 2. Supplier trust and green supplier integration: the moderating role of contract management difficulty.

5. Discussions

This study develops and examines the influence of dependence on supplier on green supplier integration, the mediating effect of supplier trust, and the moderating effect of contract management difficulty. The results of this research indicate that dependence on supplier is positively related to green supplier integration. This suggests that firms tend to initiate green supplier integration to mitigate the uncertainties and opportunisms related to dependence on supplier. Our findings about the direct impact of dependence on green supplier integration are consistent with [18,55].

Our findings also reveal that dependence on supplier has a positive impact on supplier trust. This finding indicates that dependence on supplier enables a firm to develop trust with its suppliers. In practice, supplier trust may put the firm at risk since it could be exploited by suppliers [18,56]. This research suggests that a firm which is dependent on its major supplier should take risks to trust this supplier, because the firm can expect reciprocal benefits in the future. Thus, when a firm depends

on its major supplier to achieve its goals and considers the relationship with this supplier as strategic assets, the firm will be more likely to trust this supplier.

In addition, we find supplier trust partially mediates the link between dependence on supplier and green supplier integration. This result indicates that supplier trust is critical to firms initiating green supplier integration, especially when the levels of dependence on a supplier in these firms are higher. Hence, this study highlights the important role of supplier trust in the relationship between dependence on supplier and green supplier integration.

Interestingly, the hypothesized moderating effect of contract management difficulty on the relationship between supplier trust and green supplier integration is rejected. This indicates that supplier trust has a weaker impact on green supplier integration when the level of contract management difficulty is higher. Contract management difficulty is often involved with the costs and efforts required to manage the formal contract between the firm and its suppliers. In the context of a lower level of contract management difficulty, green supplier integration is more likely to be initiated by establishing supplier trust.

One of the possible explanations for the unsupported hypothesis is that the firm and its supplier may use a contract to govern exchanges between them even if the level of trust is higher [57,58]. When the level of contract management difficulty is higher, the firm will be unwilling to integrate suppliers into joint planning and problem-solving activities regardless of the level of supplier trust. Another possible reason is that the influence of supplier trust on green supplier integration may be indirect [17]. In other words, some mediators may exist in the relationship between supplier trust and green supplier integration. Contract management difficulty may negatively affect the links between supplier trust and these mediators.

5.1. Theoretical Contributions

This article contributes to literature by extending the existing research on the enablers of green supplier integration from the perspective of inter-organizational relationship. First, this study contributes resource dependence theory, social capital theory and transaction cost theory by simultaneously investigating the influence of dependence on supplier and supplier trust on green supplier integration. Although these theories suggest that both dependence and trust are important for implementing green supplier integration, few studies have simultaneously examined their impacts on green supplier integration.

Second, this research unfolds the 'black box' of the link between dependence on supplier and green supplier integration through exploring the mediating effect of supplier trust. The mediating effect of supplier trust on the link between supplier trust and green supplier integration has been overlooked in the existing literature. This research advances our knowledge on the dependence–integration link to a more integrative framework that is more in line with practice.

Finally, this study reveals that the relationship between supplier trust and green supplier integration is negatively moderated by contract management difficulty. This finding enriches existing knowledge by exploring the boundary conditions under which supplier trust impacts on green supplier integration.

5.2. Managerial Implications

Our findings also offer novel insights for managers to effectively manage the supplier–manufacturer relationship through implementing green supplier integration. In the process of green supplier integration, the manufacturer and its suppliers share information and knowledge, make joint planning, and solve environmental problems together. This relationship may be risky since the "lock-in" is dangerous for firms when the level of dependence on supplier is higher [6]. For example, if a key supplier that is critical for the firm decides to reduce the supply to this firm and to supply more materials and components to another firm (usually a competitor), the supplier may leak the firm's knowhow to the new manufacturer. Thus, this research suggests that

a firm should develop and maintain supplier trust, which is critical to warrant the relationship with its suppliers before initiating green supplier integration.

This study suggests that firms should take a positive attitude toward dependence and deem it as an opportunity to develop trust and initiate green supplier integration. A great number of firms have realized that they should implement green supplier integration to reduce the negative influence of dependence on supplier. However, dependence on supplier may affect green supplier integration indirectly. Firms should try their best to develop a high level of supplier trust in order to reduce the uncertainties and risks related to dependence via which green supplier integration can be facilitated.

Moreover, this study reveals that the impact of supplier trust on green supplier integration is negatively influenced by contract management difficulty. This means that it is important for the firm to carefully evaluate the efforts and costs needed to manage the formal contract with its suppliers. If the level of contract management difficulty is higher, it will be difficult for firms to enhance the degree of green supplier integration through developing supplier trust. Therefore, managers should consider the control mechanisms of the supplier–manufacturer relationship before implementing green supply chain integration.

6. Conclusions and Limitations

Close relationships with supply chain partners are deemed one of the most important sustainable advantages [59]. By developing a stable and long-term relationship, supply chain partners are more willing to commit resources to the relationship [17,18]. Moreover, supply chain partners will be integrated into a well-managed chain via building intimate relationships [59]. Therefore, it is crucial to improve the understanding of inter-organizational relationships and green supply chain integration. This study contributes to this aim by establishing and empirically examining a dependence-trust-integration model using survey data from 187 Chinese manufacturing companies. In this article, we investigate the influence of dependence on supplier on green supplier integration, the mediating role of supplier trust, and the moderating role of contract management difficulty. Our findings reveal that dependence on supplier has positive effects on green supplier integration and supplier trust. We also find that supplier trust partially mediates the relationship between dependence on supplier and green supplier integration. Furthermore, contract management difficulty negatively moderates the relationship between supplier trust and green supplier integration.

This research has several limitations, which open up avenues for future study. First, this research uses dependence on supplier, supplier trust and green supplier integration as unidimensional constructs. Future research could investigate the relationship among different dimensions of these three constructs. Second, as this study only collects data from manufacturers, it would be useful for future research to collect data from both manufacturers and suppliers. Third, other moderators may exist to influence the dependence-trust-integration relationship. Future research might extend and enrich green supply chain management literature by examining the moderating effects of other moderators, such as environmental uncertainties, organizational capabilities, and firm characteristics. Finally, our findings concerning the relationships among dependence on supplier, supplier trust, green supplier integration and contract management difficulty are based on survey data from Chinese manufacturing companies which may restrict their generalizability. To revalidate these relationships in other contexts with different cultures, future studies could extend our findings by examining these relationships in other contexts.

Appendix A. Results of Non-Responding Bias

Table A1. Results of non-responding bias.

Responding and Non-Responding Firms	Responding Firms	Non-Responding Firms	*t* Value	*p* Value
Firm size	6.635	6.476	0.702	0.483
Firm age	2.575	2.522	0.634	0.526
Early and Late Responses	**Early Responses**	**Late Responses**	***t* Value**	***p* Value**
Firm size	6.681	6.437	0.738	0.462
Firm age	2.590	2.512	0.562	0.575
Longevity of relationship	1.712	1.581	1.148	0.252
Competitive intensity	5.429	5.155	1.185	0.238
Dependence on supplier	5.176	5.680	−1.629	0.114
Supplier trust	5.284	5.600	−1.177	0.241
Green supplier integration	4.916	4.581	1.518	0.131
Contract management difficulty	3.871	3.543	1.135	0.177

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