

## Article

# How Do New Ventures Implementing Green Innovation Strategy Achieve Performance Growth?

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**Abstract:** Manufacturing new ventures aiming to realize green innovative development play an essential role in the process of realizing the green transformation of economy and society. However, there is limited research on green manufacturing new ventures, and scholars have different views on whether green innovation strategy can improve new venture performance. This paper attempts to fill this gap by proposing a comprehensive framework of the relationship among green innovation strategy, green knowledge sharing, business model innovation, and new venture performance, based on the natural resource-based view. Through the empirical analysis of 240 sample enterprises in China, the results show that green innovation strategy has a significant positive effect on new venture performance. Green knowledge sharing and business model innovation are the essential paths for new ventures to achieve performance growth. Additionally, green knowledge sharing and business model innovation play a chain mediating role between green innovation strategy and new venture performance. This study suggests directions for manufacturing new ventures implementing a green innovation strategy to enhance performance and establishes a theoretical basis for the green transformation development of China's economy and society.



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**Keywords:** green innovation strategy; new venture performance; green knowledge sharing; business model innovation

## 1. Introduction

In recent years, China has made great achievements in economic development. However, environmental issues such as environmental pollution, resource waste, greenhouse gas emissions, and habitat destruction caused by economic production activities are becoming increasingly serious [1]. As the economy and society pay more attention to environmental protection and sustainability, the Chinese government has proposed a series of measures to help promote environmental protection and sustainable economic and social development, such as “green manufacturing”, “carbon emission peak”, and “carbon neutrality” projects. Among them, these measures are found to be relevant to manufacturing enterprises. The manufacturing industry, as an essential engine of China's economic growth and a main sector of energy consumption and carbon emissions, is considered to be the key to achieving environmental goals. Therefore, on the one hand, manufacturing enterprises are under unprecedented environmental pressure, and on the other hand, they are also confronted with opportunities for green development. Only by seizing the great opportunities brought by economy and society, green transformation and realizing innovation-driven green transformation and upgrades, can manufacturing enterprises shape their competitive advantage in a green market and achieve long-term development in the future.

Reviewing the existing research, the green transformation of large enterprises has attracted more attention from scholars. It is generally believed that green development requires a large amount of resource investment, while large enterprises have more tangible

and intangible resources to support green innovation. However, in fact, small and medium-sized enterprises are the source of vitality for economic development, and they tend to be responsible for more than 60 per cent of the environmental impact [2]. More entrepreneurs attempt to seize the opportunity of the green market and set up new ventures aiming at green development. Compared with large scale enterprises, the new ventures are more flexible and have stronger innovation capacity. When the external environment changes, new enterprises could respond and adjust more quickly. As a result, manufacturing new ventures have the potential to transform environmental issues into business solutions based on innovation by serving as green executors or green innovators. In the end, solutions to substantial environmental problems and significant improvement of economic performance will be realized [3]. Hence, the implementation of a green innovation strategy may become the key to obtain green competitive advantages for manufacturing new ventures in the new period. Based on the above analysis, we focus on new ventures to explore the green innovative development of new ventures, which may be more beneficial to promote the green transformation of economy and society.

However, new ventures present “liability of newness”, especially those aiming at green innovative development. They may face more severe challenges. Therefore, how to maintain survival and achieve successful development and performance growth of enterprises needs more attention. Reviewing the existing research, it is found that there are inconsistent views on whether green innovation strategy can enhance new venture performance. Some scholars believe that the green operation of enterprises requires a lot of resource investment, and the benefits remain uncertain. Moreover, compared with large scale enterprises, the resource investment of new ventures in green innovation will increase the operating burden to a greater extent and weaken the profitability of enterprises. Nevertheless, other scholars, such as Porter and van der Linde, also pointed out that the green behavior could bring an “innovation offsets” effect, which contributes to shaping differentiated competitive advantages of the enterprises and improved organizational performance [4]. To sum up, we hold that there may be an undiscovered path mechanism between green innovation strategy and new venture performance, which leads to the inconsistent views.

Previous studies have pointed out that green innovation strategy can boost enterprises to seize green opportunities through innovative means and production processes, so as to improve new business models. Business model innovation is considered as a value creation activity involving complex knowledge fusion and innovation [5]. It is also an enterprise’s disruptive innovation behavior that breaks existing balance. However, limited by resource endowment, it is difficult for new ventures to support effective innovation activities through existing resources and capabilities. Therefore, it is necessary to apply external forces to promote green innovation events. Prior studies have found that valuable resources to encourage innovation activities could be mobilized through network relationships [6]. Green knowledge sharing is regarded as a process of sharing or transferring green marketing and technical knowledge between manufacturers and their supply chain members [7]. These stakeholders could be sources of resources and capabilities for new ventures, which is conducive to the development of new ventures’ innovation activities and shape competitive advantage. Nevertheless, there is still insufficient research on the role of green knowledge sharing and business model innovation between green innovation strategy and new venture performance.

Based on the above analysis, this paper constructs a comprehensive framework of the relationship between green innovation strategy, green knowledge sharing, business model innovation, and new venture performance. Furthermore, we take 240 Chinese manufacturing new ventures to empirically examine the relationship between these four variables. Different from previous studies, this paper mainly focuses on new ventures, explores the relationship between green innovation strategy and new venture performance, as well as the essential path for new ventures implementing a green innovation strategy

to achieve performance transformation; that is, whether green knowledge sharing and business model innovation play a mediating role between them.

The main contributions of this study are as follows: First, we expand the research on environmental strategy in the context of new ventures. Previous studies mostly focused on the green transformation of large enterprises, while ignoring the significance of new ventures aiming at green innovative development for sustainable economy and society development. Therefore, this paper complements the existing literature on environmental strategies by regarding new ventures as the research objects to explore the green innovative development of them. Second, we open the “black box” of the effect of green innovation strategy on new venture performance, verify the positive relationship between them, and find that green knowledge sharing and business model innovation are two essential paths for the transformation of green innovation strategy into new venture performance, which enrich the existing research conclusions on the relationship between green innovation strategy and new venture performance. This study lays a theoretical and empirical foundation for the performance improvement of new ventures implementing a green innovation strategy and puts forward valuable suggestions for promoting green transformation of economy and society.

The remainder of this paper is organized as follows: Section 2 reviews the existing literature and derives our hypotheses. Section 3 introduces sample analysis and data collection methods. Section 4 argues the empirical research results in this paper. Section 5 discusses the findings as well as theoretical and managerial implications. Section 6 discusses the limitations and suggests directions for future research.

## 2. Literature Review and Hypotheses

### 2.1. Green Innovation Strategy and New Venture Performance

The prerequisite for new ventures to achieve great development is to strategically find a niche market where it increases their chances of success [8], while environmental strategy is considered as an important means to shape competitive advantages and achieve performance growth by reducing costs or implementing product differentiation [9,10]. As a proactive environmental strategy, green innovation strategy is regarded as an enterprise’s innovation strategy related to developing green product innovation and green processes innovation [11]. It can reduce environmental burden, enhance competitive advantage, and improve corporate performance by promoting effective utilization of tangible and intangible resources of the enterprise [12]. Although the resource reserves and production scales of new ventures are difficult to compare with large enterprises, their flexibility, market response capacity, and agility are more prominent than large enterprises, which is conducive to developing innovation activities [13]. According to previous studies, and different from reactive environmental strategy, proactive environmental strategy will increase operating costs and R&D investment at least in the short term, and thus it may have a negative impact on corporate performance [14]. However, some scholars believe that the green behavior of enterprises can bring an “innovation offsets” effect which creates unique competitive advantages different from competitors to improve corporate performance [4]. With the development of research, more researchers believe that proactive environmental strategy is conducive to improving production and operation quality, thus increasing the enterprises’ profitability and efficiency [15,16]. Enterprises could further reduce production and operation costs, as well as improve economic efficiency and performance, by carrying out innovations related to green and environmental protection, such as reducing energy consumption, reusing production materials, and perfecting production processes [17–19]. Furthermore, enterprises with a high level of environmental commitment tend to acquire a better ecological image and higher social approval [20,21], which establishes superiority in the market. By satisfying the demands of environmentally sensitive customers for environmental products, enterprises could benefit from premiums and gain higher income [22]. It is helpful to increase an enterprise’s cash flow and business performance [19]. Based on the above analysis, the following hypothesis is proposed in this study:

**Hypothesis 1 (H1).** *Green innovation strategy has a positive impact on new venture performance.*

### *2.2. Green Innovation Strategy, Green Knowledge Sharing, and New Venture Performance*

According to the natural resource-based view, enterprises need to constantly develop environmental resources and capabilities to cope with complex environmental requirements and build competitive advantages [15]. Knowledge resources are considered as the most unique resources in the enterprise. They can be created, shared, and utilized across the enterprises' functional boundaries [23]. In particular, the implementation of innovation strategies of new ventures needs the flow of knowledge to help them achieve strategic goals, perfect processes, and improve product and service quality. Meanwhile, the concern about environmental issues also urges enterprises to acquire green knowledge and technology to develop new environmental solutions [24]. Due to the fluidity and invisibility of specific knowledge, in addition to the existing knowledge, green knowledge from supply chain partners is needed to help new ventures to recognize innovation opportunities [25,26], and creates value through management and technology. Therefore, seeking green knowledge sharing with supply chain partners is essential for new ventures' developing. Green knowledge sharing refers to the process of sharing or transferring green marketing and technical knowledge between manufacturers and their supply chain members. It consists of green suppliers sharing and green customers sharing [7]. Through the exploitation of novel technologies and opportunities, green knowledge sharing is conducive to reducing the negative effects of production and operating activities on the environment. Compared with large-scale enterprises, new ventures implementing proactive environmental strategy generally endure severe resource constraints. However, their flexibility, agility, and proximity to customers are able to transfer information flow (e.g., knowledge resources) concisely and efficiently [27]. A strong commitment to pollution abatement and environmental protection promotes information exchange and knowledge sharing between enterprises and their supply chain partners that have the same intentions [28,29]. This forms a broader knowledge collection, which makes enterprises more flexible and creative in coping with environmental challenges. Wong pointed out that sharing green knowledge with supply chain network members presented reciprocity [30]. Through sharing and exchanging green knowledge as well as resources, enterprises are able to connect their skills and knowledge with the complementary capabilities from other network members. Suppliers can provide knowledge or participate directly in the innovation processes as co-creators or co-producers [31]. Furthermore, maintaining a close relationship with customers on environmental issues facilitates the sharing and exchange of green information and requirements between enterprises and customers [32]. Exchanging heterogeneous resources and specific knowledge and information with key suppliers and customers increases the enterprise's possibility of opportunity identification, while reducing the occurrence of information asymmetry. It is also conducive to synergistic benefits in knowledge creation and creating value [33]. Based on the above analysis, the following hypotheses are proposed in this study:

**Hypothesis 2 (H2).** *Green knowledge sharing mediates the relationship between green innovation strategy and new venture performance.*

**Hypothesis 2a (H2a).** *Green supplier sharing mediates the relationship between green innovation strategy and new venture performance.*

**Hypothesis 2b (H2b).** *Green customer sharing mediates the relationship between green innovation strategy and new venture performance.*

### *2.3. Green Innovation Strategy, Business Model Innovation, and New Venture Performance*

The sustainability challenge has been regarded as an opportunity to shape competitive advantage and achieve advanced performance for enterprises. Thus, the demand for greater sustainability is considered to be a momentous prerequisite to carry out business model

innovation for enterprises [34]. Prior studies have pointed out that new ventures advocating a green innovation strategy could lead a novel business model. Green innovation strategy is able to effectively promote enterprises to actively seek new technologies and a novel business model, exploit eco-friendly products to achieve economic benefits, and meanwhile reduce or even eliminate the pollution and waste to the maximum extent [24]. Furthermore, a green innovation strategy accelerates the quest for business model innovation with an open mind, which includes exploiting new environmental materials or processes, designing new products following a sustainable life cycle [35], and innovating the use of materials and energy, as well as the efficient manufacturing processes, forming the new correlation with supply partners, and creating new value. New ventures involving a green innovation strategy are capable of seizing new opportunities in the green market through allocating resources, exploring and acquiring green technologies and knowledge, and developing innovative business solutions as well [36]. Specifically, new ventures are able to select the most effective resource combination for the purpose of green innovation [37], thus reducing the uncertainty that enterprises with green characteristics generally have, and by improving the profitability and stability of an enterprise's operations. Furthermore, by bringing a good reputation, a green innovation strategy facilitates enterprises to form a virtuous innovation cycle, and stimulates exploration of knowledge, network relationships, and intangible resources (such as the green image). Moreover, it increases the possibility to innovate in green products, processes, partners, and trading [3], which is conducive to promoting the economic performance. Therefore, according to the logic of "strategy-behavior-performance", new ventures involving a green innovation strategy will bring environmentally friendly commercial output to improve performance through promoting business model innovation. Based on the above analysis, the following hypothesis is proposed in this study:

**Hypothesis 3 (H3).** *Business model innovation mediates the relationship between green innovation strategy and new venture performance.*

#### *2.4. The Chain Mediating Effect of Green Knowledge Sharing and Business Model Innovation*

Innovation activities in new ventures may be limited by internal resource availability [3]. Taking measures on the innovation development of a product or business model could ultimately lead to complex changes in the system. However, completing these changes may be beyond the resources and capabilities that a single enterprise currently possesses [38]. Therefore, enterprises, especially the new ventures, need to continuously acquire new knowledge, technology, and information resources to develop business model innovation, provide new business solutions for customers, and then create new value [39]. The realization of business model innovation requires complex knowledge fusion and innovation [5], especially the acquisition of technology and knowledge from stakeholder networks [40], because the successful practice of a novel business model demands creativity, insights, and a large amount of information about customers, competitors, and suppliers. Green knowledge sharing is considered as the sharing and exchange behavior of green knowledge, information, and technology from key suppliers and customers. It encourages knowledge transfer rooted in organizational routines and contributes to the stimulation of knowledge creation and innovation capacity.

First of all, contact and participation with suppliers of a product or process design at the early stage will contribute to the cooperation in development of new products and processes [41], identify the potential problems of new products with green attributes [42], improve the green R&D capability, and enhance the output efficiency of green achievements. The process of knowledge assimilation with suppliers is helpful for new enterprises to perfect existing products or services and reduce unnecessary pollution and waste caused by production and operation activities. Suppliers providing environmentally friendly green production materials or reusable raw materials and components could effectively promote manufacturers to modify or adjust existing product designs [43] and achieve business

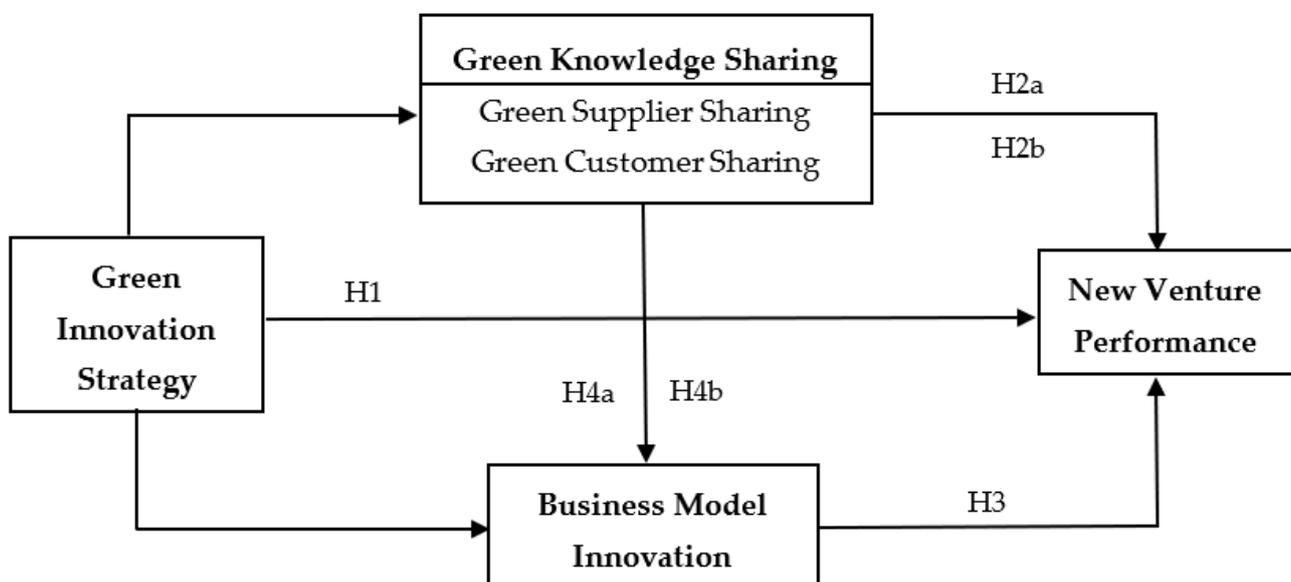
model innovation and commercial output. Secondly, green knowledge sharing between new ventures and customers could facilitate information sharing and understanding, which supports new enterprises to have insights into customers' preferences for eco-friendly products, and fits consumers' high-level green needs through innovative activities [44]. On the other hand, green demands from consumers' preferences could also urge new ventures to continue to innovate and perfect green technology in production and operation [45]. Additionally, sharing green knowledge with customers could enhance the environmental commitment of new ventures. This is conducive to promoting customers' awareness and loyalty to enterprises and lays a good foundation for continuous profitability of new enterprises. Based on the above analysis, the following hypotheses are proposed in this study:

**Hypothesis 4 (H4).** *Green knowledge sharing and business model innovation chain mediates the relationship between green innovation strategy and new venture performance.*

**Hypothesis 4a (H4a).** *Green supplier sharing and business model innovation chain mediates the relationship between green innovation strategy and new venture performance.*

**Hypothesis 4b (H4b).** *Green customer sharing and business model innovation chain mediates the relationship between green innovation strategy and new venture performance.*

The research framework is shown in Figure 1. We develop a comprehensive framework in which green knowledge sharing and business model innovation mediate the relationship between green innovation strategy and new venture performance.

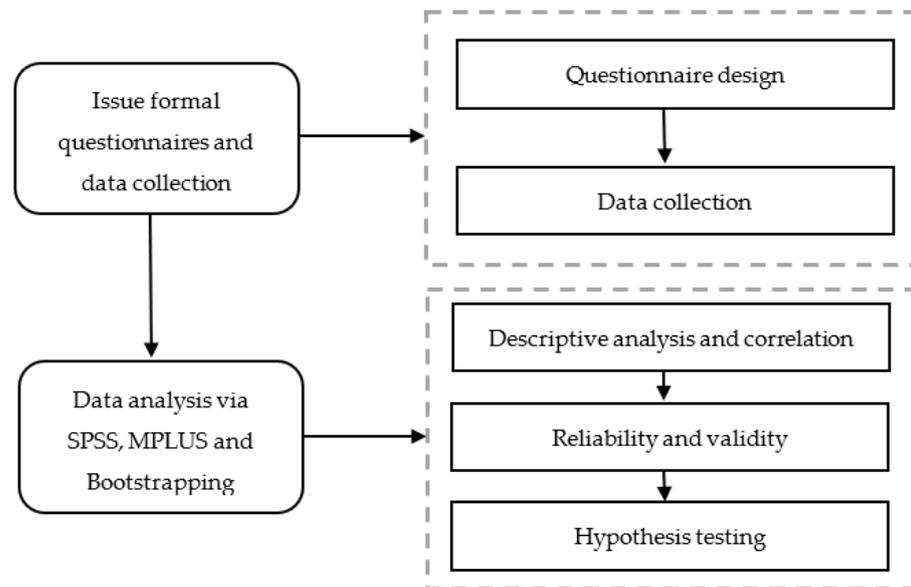


**Figure 1.** Conceptual model.

### 3. Research Design

#### 3.1. Research Steps

The empirical test of this paper follows the following steps (see Figure 2). First, we designed the questionnaire and collected the data from the target enterprises. Then, we used statistical software to further process the data and check the reliability, validity, correlation, and other indicators. Finally, the hypotheses of this paper were tested.



**Figure 2.** Research methodology process.

### 3.2. Sample and Data Collection

In this study, manufacturing new ventures were selected as our objects because their business activities are more likely to have an effect on environment. In addition, we focused the research context on China, because China, as a developing country, has experienced rapid economic growth with serious pollution problems [1]. At present, entrepreneurship research generally regards enterprises that have been established for no more than 8 years as new ventures [46,47], so we followed this convention and defined new ventures.

Compared with listed companies, it was hard to access to new ventures' managers in different provinces in China. Thus, at first, we distributed questionnaires to qualified entrepreneurs through our own network relationships. Then, we adopted snowballing to obtain more target enterprises. It is useful for getting in touch with hard-to-reach people [48]. In order to promote the response rate of questionnaires, we promised to provide detailed analysis reports for the interviewees and emphasized anonymity in the process of answering. Finally, a total of 342 questionnaires were distributed, and 240 valid questionnaires were obtained after eliminating invalid samples. The effective rate of sample recovery was 70.18%.

Among these samples, the subjects accounted for 69.17% of males and 30.83% of females. According to the industry classification of the 2017 national economy, the sample enterprises engaged in pharmaceutical manufacturing and electronics, in addition to communication equipment manufacturing accounting for the largest proportion, accounting for 37.92% and 33.75%, respectively. Medical instrument and instrument manufacturing, as well as aviation, spacecraft, and equipment manufacturing accounted for 10.00% and 9.17%, respectively. Computer and office equipment manufacturing, as well as information chemical manufacturing, accounted for 5.00% and 3.33%. Others accounted for 0.83%. In view of China's vast territory, we divided China into four regions to achieve a more comprehensive coverage of the sample enterprises; that is, northeast region, east region, west region, and central region. Most of the sample enterprises were located in northeast China, accounting for 61.25%. Meanwhile, the east region accounted for 17.92%. The west region and central region accounted for 10.83% and 10.00%, respectively.

To make our research more rigorous, this paper evaluated the non-response bias. We used a t-test to compare the differences between early and late responses [49]. The results showed that the non-response bias could be neglected.

In this study, some measures were taken to intervene in common method variance (CMV). In the beginning, the respondents answered the questionnaire anonymously with the mixed items. Then, we used Harman's single-factor test to examine the potential threat,

while the result suggested that CMV could not be a serious problem. Finally, the result of the one-factor model also showed CMV did not need extra attention [50] ( $\chi^2/df = 5.857$ , RMSEA = 0.142; SRMR = 0.151; CFI = 0.463; TLI = 0.424).

### 3.3. Measures

First, based on Chan's research, we used 7 items to measure the new ventures' implementation situation of a green innovation strategy [51]. Second, the measurement of green knowledge sharing referred to the research of Song et al. Additionally, green knowledge sharing was divided into 2 dimensions: green supplier sharing and green customer sharing [7]. Each dimension was measured by 5 items. Business model innovation was measured by 9 items according to the research of Zott and Amit [52]. Finally, we used 5 items which were adopted from Cui et al. to measure new venture performance [53]. All items were measured on 7-point Likert scales, ranging from 1 (strongly disagree) to 7 (strongly agree). The constructs' details and items are listed in Appendix A.

Furthermore, we should consider additional effects caused by other factors, especially the firm's age. Although the research objects of this study were limited to new ventures established within 8 years, we still needed to pay attention to the influence of the difference in resources caused by time on the green development of new ventures. Thus, we made firm age control variables in this paper, and it was measured by the years that firms had operated. "1" = less than 3 years, "2" = 3–5 years, "3" = 5–8 years.

## 4. Results

### 4.1. Descriptive Analysis and Correlation

Table 1 shows the means, standard deviations, and correlations of all variables. New venture performance positively relates to green innovation strategy ( $r = 0.307$ ,  $p < 0.01$ ), green supplier sharing ( $r = 0.346$ ,  $p < 0.01$ ), green customer sharing ( $r = 0.289$ ,  $p < 0.01$ ), and business model innovation ( $r = 0.322$ ,  $p < 0.01$ ). Green innovation strategy is positively related to green supplier sharing ( $r = 0.237$ ,  $p < 0.01$ ), green customer sharing ( $r = 0.309$ ,  $p < 0.01$ ), and business model innovation ( $r = 0.362$ ,  $p < 0.01$ ). In addition, there is a positive relationship between green supplier sharing and business model innovation ( $r = 0.244$ ,  $p < 0.01$ ). Green customer sharing positively relates to business model innovation ( $r = 0.245$ ,  $p < 0.01$ ). The results are consistent with the hypotheses and provide support for further empirical tests.

**Table 1.** Means, standard deviations, and correlation.

	1	2	3	4	5	6
1 Firm Age						
2 GIS	0.027	0.789				
3 GSS	0.068	0.237 **	0.764			
4 GCS	0.156 *	0.309 **	0.681 **	0.780		
5 BMI	0.087	0.362 **	0.244 **	0.245 **	0.803	
6 NVP	0.122	0.307 **	0.346 **	0.289 **	0.322 **	0.764
Mean	2.34	4.71	4.81	4.87	4.69	5.00
S.D.	0.79	1.09	1.01	1.12	1.11	0.95

Note: S.D. = standard deviation; GIS = green innovation strategy; GSS = green supplier sharing; GCS = green customer sharing; BMI = business model innovation; NVP = new venture performance; similarly hereinafter. \*  $p < 0.05$ , \*\*  $p < 0.01$ . The diagonal elements are square root of AVE.

### 4.2. Reliability and Validity

In this study, we adopted SPSS 24.0 and MPLUS 7.0 to test all the variables for reliability and validity. The results are listed in Table 2. As in most studies, Cronbach's  $\alpha$  coefficients were used to evaluate reliability. It can be seen that all the Cronbach's  $\alpha$  coefficients are greater than 0.7, and the factor loading of each variable is greater than 0.6. Thus, all the variables in this study have acceptable reliability [54]. In addition, the values of composite reliability (CR) for these five constructs are 0.920, 0.875, 0.886, 0.942, and 0.875, respectively,

which ensures reliability of all the variables in this study [55]. Additionally, we tested average variance extracted (AVE). The AVE values of all variables are more than 0.5. This shows that the convergent validity is acceptable. The model fit results are as follows: ( $\chi^2/df = 1.740$ , RMSEA = 0.056; SRMR = 0.048; CFI = 0.920; TLI = 0.912). This means that the model provides a good fit for the data [50].

**Table 2.** Results of factor analysis.

Variables	Factor Loading (Min)	Cronbach's $\alpha$	CR	AVE
GIS	0.744	0.898	0.920	0.623
GSS	0.716	0.822	0.875	0.584
GCS	0.739	0.839	0.886	0.609
BMI	0.752	0.931	0.942	0.645
NVP	0.733	0.821	0.875	0.584

Note: AVE = average variance extracted; CR = composite reliability.

We also notice each variable's square root of AVE is greater than the correlation coefficient between any two variables (shown in Table 1). As a result, the discriminant validity can be verified in this study. Above all, all the variables in this study have satisfactory reliability and validity.

#### 4.3. Hypothesis Testing

We adopted SPSS24.0, in combination with the bootstrapping method, to assess the presence of the direct and indirect relationships between the variables [56]. These techniques have been widely applied in society science during the last decades. All the results are shown in Tables 3–5.

##### 4.3.1. Direct Effect

To verify the relationship between green innovation strategy and new venture performance, we set new venture performance as a dependent variable and green innovation strategy as an independent variable. Model 6 in Table 3 shows that green innovation strategy has a direct positive effect on new venture performance ( $\beta = 0.304$ ,  $p < 0.01$ ); that is, Hypothesis 1 is supported.

**Table 3.** Analysis of regression (1).

Variables	GSS		GCS				NVP			
	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10
Firm Age	0.068		0.156 *	0.148 *	0.122	0.114	0.099	0.097	0.079	0.095
GIS		0.235 **		0.30 **		0.304 **		0.237 **		0.242 **
GSS							0.340 **	0.284 **		
GCS									0.277 **	0.201 **
R <sup>2</sup>	0.005	0.060	0.024	0.118	0.015	0.107	0.130	0.183	0.090	0.143
Adjusted R <sup>2</sup>	0.000	0.052	0.020	0.110	0.011	0.100	0.122	0.172	0.082	0.132
F Value	1.102	7.545 **	5.965 *	15.778 **	3.615	14.221 **	17.678 **	17.601 **	11.691 **	13.114 **

\*  $p < 0.05$ , \*\*  $p < 0.01$ .

**Table 4.** Analysis of regression (2).

Variables	BMI		NVP	
	M11	M12	M13	M14
Firm Age	0.087	0.077	0.095	0.096
GIS		0.360 **		0.220 **
BMI			0.314 **	0.234 **
R <sup>2</sup>	0.008	0.137	0.113	0.154
Adjusted R <sup>2</sup>	0.003	0.130	0.105	0.144
F Value	1.804	18.803 **	15.026 **	14.365 **

\*  $p < 0.05$ , \*\*  $p < 0.01$ .

**Table 5.** Analysis of chain mediation effect.

Hypothesis	Path	Effect	Boot SE	Boot LLCI	Boot ULCI
H4a	Ind1(GIS→GSS→NVP)	0.053	0.023	0.019	0.111
	Ind2(GIS→GSS→BMI→NVP)	0.007	0.004	0.002	0.023
	Ind3(GIS→BMI→NVP)	0.055	0.024	0.017	0.111
H4b	Ind1(GIS→GCS→NVP)	0.049	0.024	0.012	0.107
	Ind2(GIS→GCS→BMI→NVP)	0.009	0.006	0.001	0.026
	Ind3(GIS→BMI→NVP)	0.059	0.026	0.022	0.123

#### 4.3.2. Mediating Analysis

According to Model 2 in Table 3, green innovation strategy has a significant positive effect on green supplier sharing ( $\beta = 0.235, p < 0.01$ ). It can be seen in Model 7 that there is a positive relationship between green supplier sharing and new venture performance ( $\beta = 0.340, p < 0.01$ ). Model 8 verifies that when green innovation strategy and green supplier sharing jointly affect new venture performance, both of them still have a positive effect on new venture performance. Meanwhile, the regression coefficient of green innovation strategy to new venture performance drops from 0.304 to 0.207. Therefore, green supplier sharing partially mediates the relationship between green innovation strategy and new venture performance. Hypothesis 2a is supported.

In terms of Model 4 in Table 3, green innovation strategy has a significant positive effect on green customer sharing ( $\beta = 0.305, p < 0.01$ ). It can be seen in Model 9 that there is a positive relationship between green customer sharing and new venture performance ( $\beta = 0.277, p < 0.01$ ). Model 10 verifies that when green innovation strategy and green customer sharing jointly affect new venture performance, both of them still have a positive effect on new venture performance. Meanwhile, the regression coefficient of green innovation strategy to new venture performance drops from 0.304 to 0.242. Therefore, green customer sharing partially mediates the relationship between green innovation strategy and new venture performance. Hypothesis 2b is supported.

According to Model 12 in Table 4, green innovation strategy has a significant positive effect on business model innovation ( $\beta = 0.360, p < 0.01$ ). It can be seen in Model 13 that there is a positive relationship between business model innovation and new venture performance ( $\beta = 0.340, p < 0.01$ ). Model 14 verifies that when green innovation strategy and business model innovation jointly affect new venture performance, both of them still have a positive effect on new venture performance. Meanwhile, the regression coefficient of green innovation strategy to new venture performance drops from 0.304 to 0.220. Therefore, business model innovation partially mediates the relationship between green innovation strategy and new venture performance. Hypothesis 3 is supported.

Furthermore, we used bootstrapping to test the chain mediation effect proposed by Hypothesis 4. The empirical results are shown in Table 5. The regression coefficient of the indirect effect of the path “green innovation strategy → green supplier sharing → business model innovation → new venture performance” is 0.007, and the confidence interval is [0.002, 0.023], excluding 0. The regression coefficient of the indirect effect of the path “green innovation strategy → green customer sharing → business model innovation → new venture performance” is 0.009, and the confidence interval is [0.001, 0.026], excluding 0. Thus, Hypothesis 4a and Hypothesis 4b are supported.

## 5. Conclusions

### 5.1. Discussion

In recent years, the green innovative development of manufacturing enterprises has been considered as the key to promoting the green transformation of China’s economy and society and achieve environmental goals. More entrepreneurs attempt to achieve new value creation by transforming environmental problems into business solutions based on innovation. However, how to effectively transform the performance of new ventures aiming

at green innovative development is still a vital problem to be urgently solved in the industry and academia. Therefore, based on the natural resource-based view, this study explores the mechanism of green innovation strategy on new venture performance, constructs a comprehensive framework of green innovation strategy, green knowledge sharing, business model innovation, and new venture performance, and draws the following conclusions.

First, there is a significant positive relationship between green innovation strategy and new venture performance, which is consistent with the standpoints of some scholars that green innovation strategy promotes performance growth. Dai et al. pointed out that proactive environmental strategy could facilitate the utilization of enterprise resources, weaken the negative impact of business activities on the environment, and improve operation performance [12]. Green innovation strategy could reduce the cost of production and help enterprises to shape differentiated competitive advantages through product or process innovation, thus enhancing performance [17–19]. This paper extends the research context of the existing literature. The results show that green innovation strategy also contributes to the improvement of new venture performance, which is consistent with the research of Hansen and Klewitz. They pointed out that small enterprises could take advantage of their flexibility and market response capacity to effectively drive green innovative development [13]. Dai and Xue argued that for enterprises at the growth stage, green innovative development is conducive to strengthening their profitability [57].

Second, green knowledge sharing is a crucial path for new ventures to enhance performance by implementing a green innovation strategy. The existing research on the green development of small and medium-sized enterprises mostly regards the supply chain network as the vital external force that enterprises could rely on. Jo and Kwon showed that small and medium-sized manufacturing enterprises needed to implement a green supply chain to overcome the increasingly fierce green market competition and improve their financial performance [58]. The results of our research also confirm that a green innovation strategy could enhance new venture performance by facilitating green knowledge sharing with key suppliers and key customers. This finding is consistent with several studies based on the green supply chain perspective [7,17]. Green knowledge sharing provides new ventures with green knowledge, technology, and information resources from key suppliers and customers, which lays a good foundation for new ventures to capture green opportunities in the market, develop green innovation activities, and enhance performance.

Third, business model innovation is also a crucial path for new ventures to enhance performance by implementing a green innovation strategy. However, prior studies have ignored the essential role of business model innovation in the relationship between green innovation strategy and new venture performance. In this paper, we fill this gap and verify the importance of business model innovation. At the same time, we empirically confirm some researchers' view that the pursuit of stronger sustainability is an essential antecedent for enterprises to develop business model innovation. Enterprises that advocate a green innovation strategy could lead a novel business model [34].

Finally, this paper innovatively finds the chain mediating role of green knowledge sharing and business model innovation between green innovation strategy and new venture performance, which is consistent with the conclusion of Schaltegger et al. They believed that simple knowledge and technology exchange and innovation might not maintain the competitive advantage of enterprises. Therefore, enterprises need to innovate their business models to meet the requirements of green development [59].

## 5.2. Theoretical Implications

This paper provides theoretical contributions to related literature in two aspects. First, it has enriched the environmental strategy research of new ventures. New ventures need to take responsibility for economic growth and the realization of social and environmental goals. However, there is limited research on new ventures' green innovative development. The transformation path of green innovation strategy into new venture performance is also unclear. Scholars have mostly focused on the implementation of environmental strategy

and the green transformation of large enterprises. Thus, based on existing research gaps, we focused on new ventures and attempted to expand the research context of corporate environmental strategy. The results show that green innovation strategy has a positive impact on new venture performance. The conclusions carry theoretical and empirical support for the feasibility of the new ventures' green development.

Second, this study reveals the mechanism of green innovation strategy on new venture performance. The existing research conclusions about the relationship between green innovation strategy and new venture performance are still controversial. Thus, we try to explore the specific path of transforming green innovation strategy into new venture performance. In this paper, considering the characteristics of new ventures with resource shortages and high flexibility, two variables, green knowledge sharing and business model innovation, are introduced to explain this relationship. The results show that green knowledge sharing, including green supplier sharing and green customer sharing, and business model innovation are the critical paths for manufacturing new enterprises implementing a green innovation strategy to achieve new venture performance. More specifically, green knowledge sharing and business model innovation play a chain mediating role between green innovation strategy and new venture performance. In conclusion, the findings of this study strengthen the scholarly understanding of the relationship between green innovation strategy and new venture performance, opens the black box of the impact of green innovation strategy on new venture performance, and builds a theoretical basis for manufacturing new ventures to achieve successful green innovative development.

### 5.3. Managerial Implications

This paper also offers several managerial implications. First, the implementation of a green innovation strategy may be a new path for manufacturing new ventures to achieve performance growth. In order to meet the requirements of the new period and strengthen the motivational force of development, the Chinese government put forward the new development philosophy of innovative, coordinated, green, open, and shared development. The conclusion of this paper also confirms the significance of this philosophy in guiding the development of new ventures. Promoting green innovative development of new ventures will be conducive to China's economic transformation and upgrading and will contribute to the achievement of China's environmental goals such as "green manufacturing" in the new era. By implementing green innovation strategy, manufacturing new ventures could innovate in products and services to attract more favor from environment-sensitive customers, enhance corporate social reputation and customer loyalty, build brand advantage, and benefit from the premium income brought by the environmental protection attributes of products [44]. Meanwhile, green innovation strategy can build differentiated competitive advantages by promoting enterprises to improve operation quality and reduce production costs, which increases the possibility of performance improvement.

Second, manufacturing new enterprises implementing a green innovation strategy need to strive to overcome their own resource weakness. They can achieve a large extent of knowledge and information collection by expanding their social networks and sharing green knowledge with key suppliers and customers in the supply chain network actively. By acquiring advanced green knowledge and technology from key suppliers, as well as green market information and new demands from key customers, new enterprises could facilitate proactive green innovation in products, processes, partners, and transaction methods. In this way, new business solutions can be provided for customers to achieve business model innovation, which is helpful for new ventures to create new value, complete the transformation of green innovation strategy into new venture performance, and promote the green transformation of economy and society.

## 6. Limitations and Future Research

There are certain limitations that should be mentioned in this paper. First, this study mainly focuses on new ventures in the manufacturing industry in China. However, most

of the sample enterprises are from the northeast of China, which may have a certain degree of influence on the current results due to China's vast territory. Future research may explore whether a different industry (e.g., agriculture, tourism) or enterprises in different regions will affect the relationship between green innovation strategy and new venture performance, to enrich the research on new ventures' environmental strategy. Second, we used scale measurement to measure all the variables, which may be affected by subjective perception of subjects despite our efforts to eliminate this effect. Therefore, future studies may explore the quantitative measurement of variables to reconfirm the research conclusion of this paper. Third, this research focuses on the relationship between green innovation strategy and new venture performance, as well as the transformation process of this relationship within the organization, which ignore the external factors. Therefore, in the future, contingency factors may be considered to add to this comprehensive framework, such as exploring the contingency role of competition intensity in this path mechanism to extend existing research. Finally, based on the natural resource-based view, this study verifies the mediating role of green knowledge sharing and business model innovation in the relationship between green innovation strategy and new venture performance. Future studies may consider other mediating paths or mechanisms, to expand the relevant research on the performance improvement of new ventures under a green context.

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## Appendix A

Constructs	Label	Measurement Items	Sources
GIS	GIS1	We greatly improve business operations to reduce the impact on species and natural habitats	Chan (2005) [51]
	GIS2	In the absence of explicit requirements of government regulations, we take proactive actions for environmental restoration and protection	
	GIS3	We greatly improve business practices to reduce waste and pollutant emissions	
	GIS4	We greatly improve business operations to reduce the procurement of non-renewable materials and chemical products	
	GIS5	We choose to use less polluting energy sources to reduce the use of traditional fuels	
	GIS6	We greatly improve products and processes to reduce energy consumption	
	GIS7	We greatly improve business practices to reduce the adverse impact of their products on the environment	

GSS	GSS1	The company has frequent exchanges of expertise in green product design with key suppliers	Song et al. (2020) [7]
	GSS2	The company has frequent exchanges of expertise in green processes design with key suppliers	
	GSS3	The company has frequent exchanges of expertise in green procurement with key suppliers	
	GSS4	The company has frequent exchanges with key suppliers on green knowledge related to green demand changes and customer preference changes	
	GSS5	The company has frequent exchanges with key suppliers on green knowledge related to green market demand trends and forecasts	
GCS	GCS1	The company has frequent knowledge exchanges with key customers in the feedback of green product innovations	Song et al. (2020) [7]
	GCS2	The company has frequent exchanges with key customers on green knowledge related to green market demand trends and forecasts	
	GCS3	The company has frequent knowledge exchanges with key customers on green marketing expertise	
	GCS4	The company has frequent knowledge exchanges with key customers on green distribution expertise	
	GCS5	The company has frequent exchanges with key customers on green knowledge related to green packaging design or technology	
BMI	BMI1	Our business model offers a new combination of products, services, and information	Zott and Amit (2007) [52]
	BMI2	Our business model attracts many new customers	
	BMI3	Our business model attracts many new suppliers and partners	
	BMI4	Our business model connects participants in novel ways	
	BMI5	Our business model connects participants to transactions in novel ways	
	BMI6	Our business model frequently introduces new ideas and innovations	
	BMI7	Our business model frequently introduces new operational process routines and specifications	
	BMI8	Our business model is in a leading position in the industry	
	BMI9	Our business model is novel in general	
NVP	NVP1	Compared with our competitors, our company has a higher market share	Cui et al. (2018) [53]
	NVP2	Compared with our competitors, our company's market share is growing faster	
	NVP3	Compared with our competitors, our company's sales are growing faster	
	NVP4	Compared with our competitors, the number of new employees in our company is growing faster	
	NVP5	Compared with our competitors, our company's new products or services develop faster	

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