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A Study on the Relationship between Paradox Cognition, Green Industrial Production, and Corporate Performance

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Abstract: Based on the theory of paradox cognition, a relationship model among paradox cognition, industrial green production, and enterprise performance has been constructed, which mainly focuses on a study on whether the paradox cognition can have positive influences on the green production behavior of industrial enterprises, and then further promote the improvement of enterprises' economic benefits. The author wrote this thesis on the basis of results obtained from 305 sample surveys and verified the direct and indirect influence relationships among variables in the model with structural equation path coefficient and mediation effect. The empirical results show that: firstly, paradox cognition has a positive and significant impact on the industrial green production behavior. The higher the level of paradox cognition, the more likely the enterprises are to implement the industrial green production behavior. Secondly, paradox cognition can improve the potential performance of enterprises by affecting "green product provision", "green production management", and "green production technology", and then indirectly improve the financial performance of enterprises.

Keywords: paradox cognition; green industrial production; corporate performance; structural equation

1. Introduction

Industrial production plays an extremely important role in promoting the development of national economies, but it also brings serious environmental issues [1]. The problems of how to minimize pollution, lower energy consumption, and maximally reduce environmental damage have become very important concerns in the current academic field [2,3]. In other words, the question of how to ensure environmental benefits while pursuing economic benefits has become a big challenge that industry faces during production. As the gap between energy supply and demand is increasing, industrial green production has drawn more and more attention from the public as an effective approach to energy saving and emission reduction. Industrial green production plays an important role in the reduction of energy consumption and the improvement of the ecological environment, and it can be used to effectively reduce the environmental damage caused by industrial production [4]. As early as 1996, the United Nations Environment Programme (UNEP) (which is the leading global environmental authority that sets the global environmental agenda, promotes the coherent implementation of the environmental dimension of sustainable development within the United Nations system, and serves as an authoritative advocate for the global environment) came up with the concept of industrial green production. Industrial green production is also known as cleaner production, which means

that an integrated environmental strategy is used in the production, product, and service, so as to save energy and reduce environmental pollution. The essence of industrial green production is to integrate the concept of sustainability into the entire life cycle of industrial products. On one hand, it helps the enterprises to save energy and maximally reduce environmental pollution. On the other hand, it can improve the utilization rate of resources and enterprises' competitiveness. Many researchers have proved that there is a positive correlation between industrial green production and enterprise performance. For example, in the research of Lin [5], it was believed that industrial green production could not only improve environmental benefits, but also increase the economic benefits of enterprises. Dangelico [6] believed that the green environmental protection behaviors of enterprises could improve the capacities of the organization significantly, including the coordinating capabilities of stakeholders, higher learning ability, and sustainable innovation ability, and these capabilities could bring more market benefits to enterprises. Therefore, it can be concluded that industrial green production realizes the coordination and utilization of enterprises' benefits, consumers' benefits, and environmental benefits.

Industrial green production can not only improve the core competitiveness of enterprises, but can also help those enterprises to maximally save energy and reduce environmental pollution. However, in real life, not all enterprises can accept the idea of industrial green production [7]. The basic reason is that they believe that the economic benefits for enterprises are contradictory with environmental benefits and cannot be unified. They believe that the implementation of green production can improve social and environmental benefits, but it will inevitably reduce the economic benefits for enterprises. Based on this point, many enterprises find that it is very difficult for them to make industrial green production decisions. Smith and Lewis came up with the theory of paradoxical cognition [8]. This theory indicates that economic benefits for enterprises have a close relationship with social environmental benefits, even though it looks like there is contradiction. In nature, that is a paradoxical relationship of opposition and unity.

This opinion is consistent with the concept of sustainable development. It pays attention to environmental protection while pursuing economic development, so as to ensure harmony between man and nature. Some scholars have carried out in-depth studies on sustainable development [9–11].

In paradox theory, it is thought that the paradox cognition of enterprises has a great influence on the decision making and behavior of enterprises. The higher the level of paradox cognition, the stronger the inclusiveness of the paradox and the greater the possibility of implementing green production in industry. On the contrary, the lower the cognitive level of paradox, the less the acceptance of industrial green production. Therefore, based on the paradox cognitive theory, this paper constructs a model of the relationship between paradox cognition, industrial green production, and enterprise performance, and focuses on the study of two issues. Firstly, does paradox cognition have a positive effect on the green production behavior of industrial enterprises—in other words, whether paradox cognition is the premise and basis for enterprises to decide the implementation of industrial green production. Secondly, can industrial green production activities promote increases in enterprise performance? In other words, does industrial green production relieve the contradiction between the economic benefits and environmental benefits of enterprises?

2. Literature Review

Green production is also known as cleaner production, which emphasizes that the production and operation activities of enterprises must be carried out on the basis of environmental protection and the reduction of energy consumption. It requires enterprises to change the traditional production methods and insist on suitable development in terms of the research and development of products, material selection, production, packaging, transportation, selling, pollution, recycling, and reuse, so as to achieve the goal of energy saving and environmental protection. However, in the actual production process, enterprises need to bear higher costs and certain risks in order to implement green production. The main concern for these enterprises is whether these costs and risks are worthwhile or not. In other

words, whether industrial green production can bring benefits to enterprises has become the most critical factor influencing industrial enterprises in making green production decisions. Some scholars have proved that environmental problems have significant features of externalities through their researches. [12,13]. The economic benefits of industrial enterprises come into conflict with social environmental benefits. The green production of enterprises does not bring benefits to enterprises, so relevant policies shall be made by governments to force enterprises to reduce energy consumption, environmental damage and pollution. For example, in the study of Olson [14], the author believed that the production costs of enterprises would be increased if they adopted green production to reduce energy consumption and protect the environment, and as a result, the enterprise performance would be decreased. Roxas and Coetzer [15] found that supervision and regulation policies about environmental protection affected the attitude and opinions of enterprises regarding environmental issues, and then they would adopt the strategy of sustainable development. After carrying out extensive investigation on industrial enterprises, Snell [16] found that the greater the pollution discharge, the higher the market benefits the enterprises receive; that is, there was a positive correlation between the pollution discharge and yield rate. In the above research studies, it is believed that green production behaviors cannot bring benefits to enterprises and even require higher product costs. In other words, the economic benefits for enterprises cannot be coordinated with social environmental benefits. Therefore, the green production behaviors of enterprises are the results of policy implementation, not voluntary actions of enterprises.

Some scholars hold opposing opinions on this issue, and they believe that the green production of enterprises can bring benefits to enterprises. For example, Maas [17] found that after improving the production process, enterprises improved the efficiency of resource utilization, which could reduce the production costs of enterprises further. Meanwhile, the market return of green products was greater than that of non-green products. Cheng [18] believed that the green production behavior of enterprises could improve enterprise profitability. Bai and Chang [19] believed that green production behavior could significantly improve the competitiveness of enterprises, and thus increase financial performance. The above research shows that the green production behavior of enterprises can not only reduce energy consumption and environmental impact, but also improve the efficiency of resource utilization and market returns of enterprises. This shows that green production behavior is the result of enterprises' pursuit of competitive advantage and improvement of core competitiveness.

Therefore, two completely different opinions are formed. One is that industrial green production requires higher costs, so it will reduce enterprise benefits. The other opinion is that green production behavior can improve the efficiency of resource utilization and enhance the core competitiveness of enterprises, and thus it will increase the market returns of enterprises. So, which opinion is right? Why are there two completely different viewpoints on the same issue? In our opinion, the major reason is that there is conflict and interdependence between the economic benefits for enterprises and the environmental benefits for society, but the above research studies did not take these factors into consideration. Smith and Lewis put forward the paradox cognitive theory [8], which considers that the relationship between the economic interests of enterprises and the environmental benefits for society is neither a simple irreconcilable relationship with conflict and contradiction, nor a simple consistent and mutually-reinforcing relationship. It is a paradox relationship of opposition and unity. In other words, on the surface, the economic benefits for enterprises and the environmental benefits for society are contradictory, but in essence, they are closely interdependent. Whether an enterprise can implement industrial green production actively and voluntarily depends on whether they have such paradox awareness. In recent years, from the perspective of paradox cognition, the study of pro-environment behavior of enterprises has gradually attracted the attention of scholars. For example, Smith and Lewis's research shows that paradox cognition has a great impact on the strategic decision making of enterprises [8]. Hahn et al. found that paradox cognition can help enterprises to pay attention to environmental protection while focusing on financial performance at the same time [20]. Based on the paradox cognitive theory, this study analyzed the impact of paradox cognition on the

green production behavior of industrial enterprises on the basis of two issues. The first paradox was whether cognition had a positive and significant impact on the green production behavior of industrial enterprises; the second was whether the implementation of industrial green production could increase the economic benefits for enterprises while protecting the environment and saving energy.

3. Research Model and Hypotheses

So far, different scholars have studied the factors that affect the green production behavior of industry from different perspectives, which leads to the formation of two very different views.

However, both viewpoints above ignore the influence of corporate cognition on green industrial production, since it would be a hard task to explain internal motivations and fundamental motives of enterprises to implement green industrial production if the cognitive factors of enterprises were to be excluded. Shah et al. found that firm level environmental policies and to a lesser extent relationships with external stakeholder networks were the main determinants of corporate social responsibility (CSR) in the green economy [21]. Corporate cognition in relation to green industrial production is hereby the core issue. Based on this, Smith and Lewis proposed the theory of paradox, and in this theory it is believed that the enterprise's economic benefits and social environmental benefits have neither a purely contradictory relationship nor a mutually promoting relationship. Whether the enterprise can reduce environmental pollution and save energy while achieving economic benefits depends on their paradox cognition level. The higher the paradox cognition level is, the more likely it is for them to find a way to take both economic and environmental benefits into consideration. Paradox is defined by Smith and Lewis as a relation structure between two contradictory yet interconnected elements [8], whereas paradox cognition is the process of identifying and withstanding paradoxes. There exists such a contradictory but interrelated relationship structure between the environmental benefits for society and the economic interests of enterprises since the production and operation of an enterprise cannot be separated from the natural environment, but the environmentally friendly behaviors in demand bring costs to the enterprise. Smith [22] discovered in case studies that corporate paradox cognition could be beneficial for companies to find ways to balance and further resolve contradictions. Enterprises with a higher level of paradox cognition could better and more clearly identify interrelations between subjects, could take into account issues interactively, and were more capable of more inclusive and integrated paradox resolutions. As evidenced by the research results of Hahn [20] and others, paradox cognition helps enterprises to simultaneously underline economic, environmental and social benefits. Paradox is thereby assumed in this paper as the basis and premise for enterprises to implement green industrial production.

Green industrial production refers to the way in which energy conservation can be maximized, environmental pollution be reduced, and sustainable development be achieved by industrial units through various ways within the life cycle of products. Green industrial production, having been defined and illustrated from various angles by many scholars [23], is generally constituted by the supply of green products, the use of green technologies, and the implementation of green management. Whether green industrial production can bring environmental benefits and enhance the market performance of enterprises is a very important issue. Green industrial production, as is believed by many scholars, can greatly enhance the core competitiveness [24]. Studies by many scholars have also shown a significant and positive relationship between green industrial production and corporate performance. Yet, such views are opposed by many scholars who believe the opposite, i.e., that greater risks and uncertainties lie behind green industrial production, which will lead to an increase in corporate costs and further reduce the corporate competitiveness. Higher costs that may be induced by green industrial green production are here, in this paper, considered to be short-term and temporary. In this paper, it is believed that industrial green production also brings a temporary and short-term cost increase, and industrial green production is one of the innovations. All enterprises need to make innovation for development, and all innovation activities indicate certain increase of cost. However, in the long term, the economic benefits of enterprises promoted by innovations will

be far higher than the cost. Corporate performance here is not only the direct financial performance of the enterprise, but also the internal operation status of the enterprise and the external market environment, including customer satisfaction, market share increase, corporate image, and other potential performance aspects. Corporate performance is considered from two aspects in a paper by Perramon [25]: potential performance and financial performance.

Potential performance refers to that which cannot be directly expressed in financial indicators, including the improvement of customer satisfaction, corporate image, and corporate core competence. Financial performance involves things that can be directly expressed by financial indicators. As a result, corporate performance (including both potential performance and financial performance) is hereby assumed to be positively affected by green industrial production in this paper. Based on the theory, the present paper, with green industrial production as the intermediary to construct a relationship model between paradox cognition, green industrial production, and corporate performance, as shown by Figure 1, focuses on three issues. First, whether paradox cognition is the premise and basis for enterprises to implement green industrial production, or if there is a significant and positive relationship between cognitive level and green industrial production. Second, whether the green industrial production of enterprises can improve enterprise performance. Third, if corporate performance is enhanced by green industrial production, whether green industrial production will directly impact on the financial performance or indirectly affect financial performance by affecting the potential performance of enterprises.

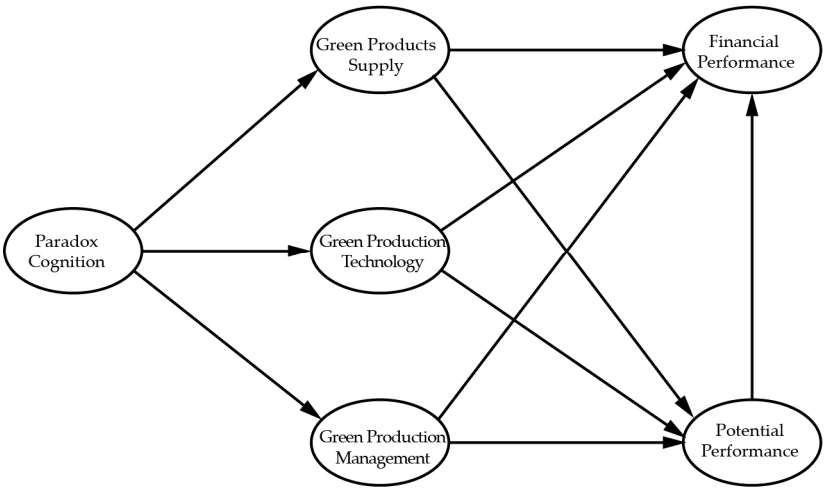

Figure 1. Theoretical model of the impact mechanism of paradox cognition and green industrial production on corporate performance.

In the paradox theory, it is believed that paradox cognition can help enterprises to recognize the paradoxes that enterprises are faced with, and can help enterprises to find a method for the contradictory balance, so as to resolve conflicts [8]. Therefore, when the enterprises realize the mutual contradiction between economic benefits and environmental benefits, as well as their interdependency, the enterprises will pay more attention to both economic benefits and environmental benefits, so as to carry out industrial green production. Therefore, in this paper, it is assumed that paradox cognition has significant and positive influences on green production behaviors (the improvement of green products, green technology and green management), and thus Hypotheses 1, 2 and 3 are formed:

Hypothesis 1. *The paradox cognition of industrial units has a positive and significant impact on green production management.*

Hypothesis 2. *The paradox cognition of industrial units has a positive and significant impact on green production technology.*

Hypothesis 3. *The paradox cognition of industrial units has a positive and significant impact on green product supply.*

Cheng [18] states that the pro-environmental behavior of enterprises can improve the profitability of enterprises. Bai and Chang [19] believe that the pro-environmental behavior of enterprises can improve enterprise competitiveness significantly, so as to enhance the financial performance. Therefore, Hypotheses 4–9 are formed:

Hypothesis 4. *Paradox cognition will positively affect the green production management of enterprises and then improve their financial performance.*

Hypothesis 5. *Paradox cognition will positively affect the green production management of enterprises, then improve the potential performance of enterprises, and finally indirectly affect the financial performance of enterprises.*

Hypothesis 6. *Paradox cognition will positively affect the green production technology of enterprises, and then improve the financial performance of enterprises.*

Hypothesis 7. *Paradox cognition has positive influence on green production technology of enterprises, thus improving the potential performance of enterprises, and finally indirectly affects the financial performance of enterprises.*

Hypothesis 8. *Paradox cognition will positively affect the provision of green products and improve the financial performance of enterprises in turn.*

Hypothesis 9. *Paradox cognition has positive influence on the supply of green products, thereby improving the potential performance of enterprises, and affecting the financial performance of enterprises indirectly.*

4. Methodology

4.1. Questionnaire Design

Questionnaires were issued to heavily-polluting and energy-intensive industrial enterprises, including steel, chemical, metallurgical, and other industries, and related issues were randomly consulted. Data involved were collected on this basis. The specific process was to set a number of questions (observational variables) for each potential variable in the model to measure the level and extent of paradox cognition, green product supply, green production technology, green production management, corporate financial performance, and corporate potential performance of industrial enterprises.

Paradox is defined by Smith and Lewis as a relation structure between two contradictory yet interconnected elements [8]. Paradox cognition is the process of identifying and withstanding paradoxes. Therefore, paradox cognition is here defined as the level of cognition of the paradox between environmental benefits and economic interests. According to the studies of Smith and Lewis [8], the following observation variables were set to measure paradox cognition (Table 1). In recent years, increasing numbers of scholars have noticed the theory of paradox, and applied this theory to their own studies [26–30].

Green product supply, as part of industrial green production, refers to products that are energy-saving, low-pollution, recyclable, and renewable. Such products have lower energy consumption and are associated with less impact on the environment. According to the studies of Chiou [31], the following observational variables were set to measure green product supply (Table 2).

Green production technology is part of the green industrial production of enterprises. Enterprises can reduce the environmental impact of the production process through various means, including independent improvement of production links and independent research and development of relevant energy-saving and emission reduction equipment. Enterprises may also work with external agencies to improve

production processes or treat pollutants. According to the studies of Zhao [32] and Cai [33], the following observation variables were set to measure green production technology (Table 3).

Table 1. Paradox cognition measurement.

Latent Variable	Question No.	Question Item
Paradox cognition	PC 1	We believe that the economic benefits for enterprises are as important as environmental benefits.
	PC 2	We also pay attention to environmental benefits while paying attention to corporate performance.
	PC 3	We believe that there is no conflict between corporate performance and environmental benefits.
	PC4	We believe that corporate environmental sensitivities can improve the market performance of enterprises.

Table 2. Green product supply measurement.

Latent Variable	Question No.	Question Item
Green product supply	GPS 1	The materials used in our products are low-pollution materials.
	GPS 2	We use relatively environmentally friendly product packaging methods.
	GPS 3	We realize more environmentally friendly products through innovation and improvement of products.
	GPS 4	We use ecological labels for our products.

Table 3. Green production technology measurement.

Latent Variable	Question No.	Question Item
Green Production Technology	GPT 1	The company is able to introduce environmentally friendly and energy-saving equipment.
	GPT 2	The company spends a lot of money on transforming existing technologies to maximize energy conservation and emission reduction.
	GPT 3	The company's green technology capabilities have changed dramatically.
	GPT 4	Production technologies adopted by the company have relatively smaller impacts on the environment.

Green production management refers to the integration of green industrial production and sustainable production into the production management of enterprises through various management reforms and innovations, thereby changing the management practices that previously only focused on economic interests and ignored environmental benefits. The following observation variables were set to measure green production management (Table 4).

Green industrial production can improve the efficiency of resource utilization, enhance the organization's ability and simultaneously bring back a good market reputation for the company. Such performances, as they cannot be expressed very intuitively, are referred to as corporate potential performance in this paper (Table 5).

Contrary to potential performance, the company's direct financial performance refers to that which is very obvious and can be directly displayed in corporate financial indicators. The following observation variables were set to measure corporate financial performance (Table 6).

Table 4. Green production management measurement.

Latent Variable	Question No.	Question Item
Green Production Management	GPM 1	The company attaches great importance to the environmental performance of the company in its management.
	GPM 2	The company has clear regulations on the energy consumption of the product throughout its life cycle.
	GPM 3	The corporate culture has a clear concept of sustainability.
	GPM 4	The company has carried out mass education regarding sustainable development for its employees.
	GPM 5	The company incorporates environmental performance into its performance appraisal system.

Table 5. Corporate potential performance measurement.

Latent Variable	Question No.	Question Item
Potential Performance	PP 1	The corporate image has been greatly improved in the past two years.
	PP 2	Customer satisfaction with the company has increased significantly in the past two years.
	PP 3	The company's ability to innovate has significantly improved in the past two years.
	PP 4	The market reputation of the company has increased year by year in the past two years.

Table 6. Corporate financial performance measurement.

Latent Variable	Question No.	Question Item
Financial Performance	FP 1	In the past two years, the company's sales revenue has significantly increased.
	FP 2	In the past two years, the company's after-tax profit has increased.
	FP 3	In the past two years, the profitability of the company has been greatly improved.
	FP 4	In the past two years, the company's ability to resist risks has been greatly improved.

4.2. Data Collection

Data for this study were collected through enterprise field questionnaires. The research samples were from Xi'an, Baoji, Xianyang, Weinan, Ankang, Yan'an, and Yulin in Shaanxi Province, as shown in Figure 2. The main respondents were middle and senior management personnel of industrial enterprises (see in Table 7). Metallurgy, textiles, chemicals, medicine, construction equipment, machinery manufacturing, communication electronic equipment, and other industries were covered by the survey. The pre-survey for the study was conducted from March 15 to March 22, 2019. A total of 50 questionnaires were distributed, and 38 valid questionnaires were returned. Twenty-five questions were set according to the six potential variables in the questionnaire, namely, paradox cognition, green product supply, green production technology, green production management, corporate potential performance, and corporate financial performance. The aforementioned pre-survey was an important reference for the design of the formal survey questionnaire. The formal survey for the study was conducted from April 10 to May 20, 2019. A total of 350 questionnaires were distributed, and 305 valid questionnaires were returned. All questions in this questionnaire were declarative, and respondents could indicate their degree of recognition of the questions in the questionnaire as per the specific conditions of the enterprise. In this questionnaire, at least three observation variables were set for each potential variable (facet). Options designed in the questionnaire were measured by the Likert Scale [34]. Scores were arranged from the lowest to the highest, indicating the degree of recognition from low to high, specifically, 1 (completely disagree), 2 (disagree), 3 (slightly disagree), 4 (unsure), 5 (slightly agree),

6 (agree), and 7 (fully agree) [34]. According to the recommendation of Hair et al. [35], in the process of structural equation modeling, the ratio between the number of samples and the number of observed variables should be between 1:10 and 1:15, and the appropriate number of samples is from 200 to 400. A total of six facets and 25 questions were contained in the model established in the study. Hence, 305 samples were used to meet the structural equation modeling sample size requirements.

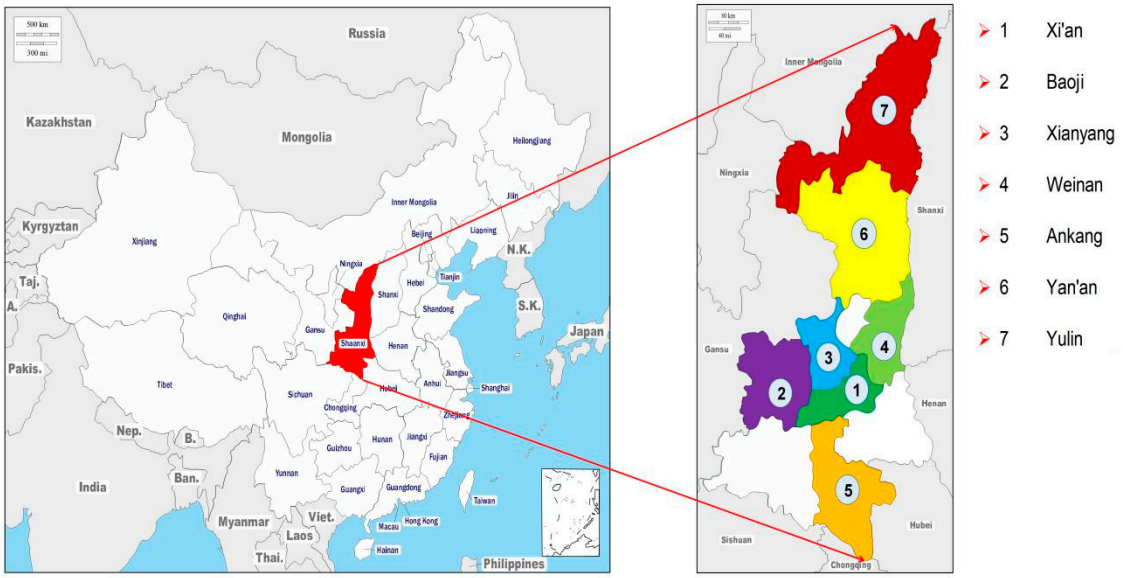

Figure 2. Surveyed regions.

Table 7. Sample descriptive statistics.

Item	Type	Quantity	Proportion	Item	Type	Quantity	Proportion
State-owned /Private	State-owned	125	41%	Respondent Gender	Male	216	71%
	Private	180	59%		Female	89	29%
Industry	Metallurgy	33	11%	Region	Xi'an	67	22%
	Textile	47	16%		Baoji	53	17%
	Chemical	41	13%		Xianyang	44	14%
	Pharmaceutical	28	9%		Weinan	29	9%
	Construction	36	12%		Ankang	26	8%
	Manufacturing	67	22%		Yan'an	35	11%
	Electronics	53	17%		Yulin	51	17%
Corporate Scale (Operating Revenue)	Large	34	11%	Respondent Age	Over 50	52	17%
	Medium	123	40%		45–50	68	22%
	Small	87	29%		40–45	89	29%
	Micro	61	20%		30–40	74	24%
					Below 30	22	7%

5. Results

5.1. Measurement Model

A total of 305 valid questionnaires were obtained in this study. See Table 8 for the results of the reliability and validity tests. The Cronbach's α values of each facet in the model exceeded the acceptable standard of 0.7, indicating a good reliability of the questionnaire. According to the test values in Table 8, other indicators including standardized factor load, combination reliability (CR), and average variance extraction (AVE) were all in compliance with the requirements. All standardization factor loads are greater than 0.6, and the non-standardized test is significant. CR values were all greater than 0.7 and in conformity with the recommended standards of Fornell and Larcker [36], and of Hair [35]. At the same time, AVE values were all greater than 0.5, which also meets the standards recommended by Fornell and Larcker [36]. Therefore, it was concluded that the validity of each facet was good.

Table 8. Reliability and convergence validity.

Latent Variable		Estimation of Parameter Significance				Factor Loading	Question Reliability	Composite Reliability	Convergent Validity	Cronbach's Alpha
		Unstd.	S.E.	*t*-Value	*p*	Std.	SMC	CR	Average Variance Extraction (AVE)	α
Paradox Cognition	1	1.000				0.699	0.489	0.768	0.455	0.767
	2	1.012	0.109	9.307	***	0.699	0.489			
	3	1.053	0.114	9.266	***	0.693	0.480			
	4	0.843	0.100	8.397	***	0.600	0.360			
Green Production Management	1	1.000				0.748	0.560	0.843	0.519	0.843
	2	0.966	0.079	12.167	***	0.759	0.576			
	3	0.969	0.087	11.098	***	0.688	0.473			
	4	0.898	0.081	11.027	***	0.683	0.466			
	5	0.930	0.080	11.617	***	0.721	0.520			
Green product Supply	1	1.000				0.685	0.469	0.807	0.512	0.805
	2	1.230	0.123	10.029	***	0.709	0.503			
	3	1.044	0.104	10.014	***	0.708	0.501			
	4	1.243	0.119	10.431	***	0.757	0.573			
Green Production Technology	1	1.000				0.757	0.573	0.852	0.594	0.847
	2	0.914	0.071	12.806	***	0.745	0.555			
	3	1.132	0.078	14.595	***	0.901	0.812			
	4	0.879	0.078	11.225	***	0.659	0.434			
Financial Performance	1	1.000				0.749	0.561	0.904	0.703	0.902
	2	1.196	0.073	16.385	***	0.915	0.837			
	3	1.202	0.075	16.008	***	0.890	0.792			
	4	1.022	0.073	14.012	***	0.788	0.621			
Potential Performance	1	1.000				0.774	0.599	0.846	0.578	0.845
	2	1.021	0.078	13.133	***	0.798	0.637			
	3	0.969	0.077	12.607	***	0.759	0.576			
	4	0.820	0.070	11.773	***	0.708	0.501			

Note: *** Significant at $p < 0.001$.

In addition to the above indicators, in order to test the degree of difference between the various facets (latent variables) in the model, a difference validity test was also performed. According to research of Fornell et al. [36], when the square root of the corresponding AVE value of facets (potential variables) is greater than the Pearson correlation coefficient between the facet and other facets, the discriminant validity of potential variables is proved to be good. It can be seen in Table 9 that the square root of the AVE value corresponding to each facet (latent variable) was larger than the Pearson correlation coefficient between the facet and other facets, which indicates that the potential variables in the model had good discriminant validity.

Table 9. Discriminant validity.

	AVE	PP	GPT	FP	GPS	GPM	PC
PP	0.578	**0.760**					
GPT	0.594	0.501	**0.771**				
FP	0.703	0.701	0.411	**0.838**			
GPS	0.512	0.794	0.418	0.663	**0.716**		
GPM	0.519	0.508	0.255	0.386	0.526	**0.720**	
PC	0.455	0.616	0.368	0.591	0.654	0.544	**0.675**

Note: The square root of AVE between the corresponding latent variables and the remaining variables are in bold, and this can be regarded as Pearson correlation values between latent variables. PP—paradox cognition; GPT—green production technology; FP—financial performance; GPS—green product supply; GPM—green production management; PC—paradox cognition.

5.2. Structural Model

AMOS 21.0 was utilized, and the 305 samples' data obtained from the questionnaire and the theoretical model were fitted to the structural equation model in this stage. As shown in Figure 3, the better the fit index is, the closer it is to the actual situations of the model and the sample. In this study, Chi-square, degrees of freedom (df), Chi-square/df ratio, goodness-of-fit index (GFI), adjusted goodness-of-fit index (AGFI), normed fit index (NFI), Tucker–Lewis Index (TLI), comparative fit index (CFI), and root mean square error of approximation (RMSEA) were used to measure the fit of the model, as shown in Table 10. A high goodness of fit between the model and the data was shown by comparing the actual fit index with the ideal value, indicating that the theoretical model was of reasonable applicability.

Table 10. Model fit test table.

Fitness Index	Measured Fit	Ideal Fit
Chi-square	448.315	
Df	265	
Chi-square/df	1.692	≤3
RMSEA	0.048	<0.08
GFI	0.897	>0.80
AGFI	0.874	>0.80
NFI	0.890	>0.90
TLI	0.945	>0.90
CFI	0.952	>0.90

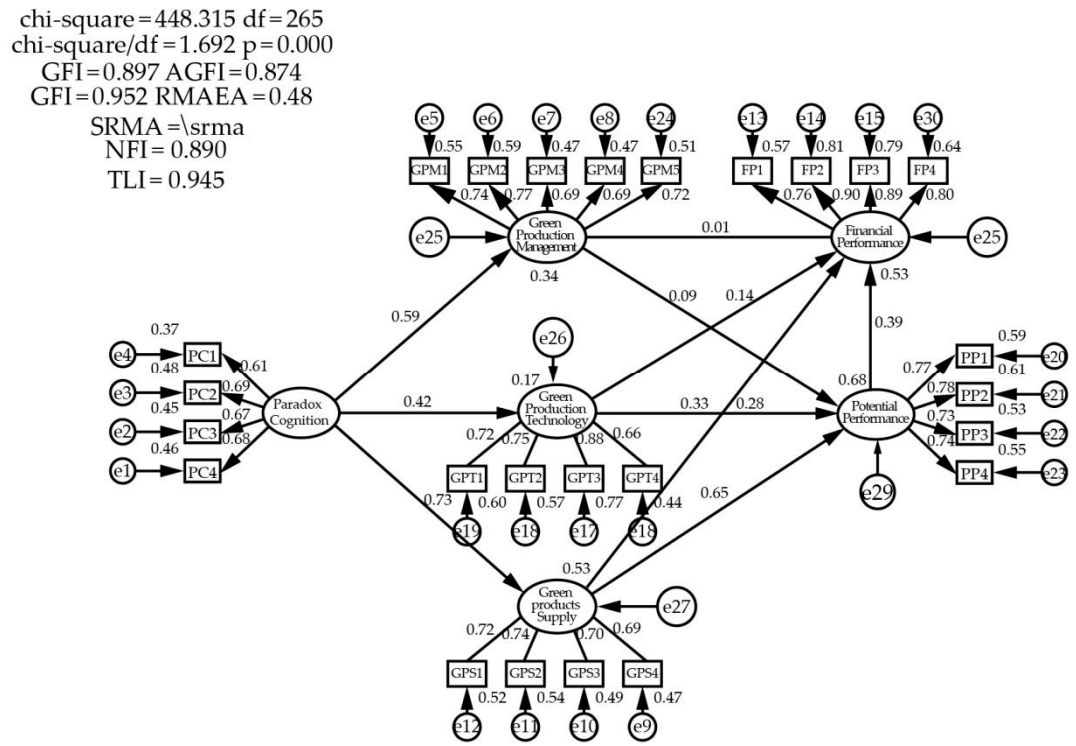

Figure 3. Standardized theoretical model of the impact mechanism of paradox cognition and green industrial production on corporate performance.

5.3. Hypothesis Testing

Table 11 is a path coefficient table of the theoretical model, according to which the path coefficients of the model are reported and the hypotheses are thereby examined. According to Table 11, the impact of green production management on direct financial performance and the impact of green production technology on financial performance were not significant. Meanwhile, significance was shown by all other paths in the structural equation model.

Table 11. Path coefficients of the model.

Path Name	Standardized Estimated Value	Non-Standardized Estimated Value	Standard Error	*p*	Significance
PC → GPM	0.587	0.503	0.068	***	Significant
PC → GPT	0.417	0.461	0.083	***	Significant
PC → GPS	0.728	0.738	0.089	***	Significant
GPM → PP	0.136	0.163	0.068	0.017	Significant
GPT → PP	0.226	0.209	0.050	***	Significant
GPS → PP	0.653	0.659	0.079	***	Significant
GPM → FP	0.008	0.010	0.067	0.884	Not Significant
GPT → FP	0.093	0.083	0.051	0.107	Not Significant
GPS → FP	0.331	0.323	0.100	0.001	Significant
PP → FP	0.390	0.377	0.108	***	Significant

Note: significance level: $p < 0.001$ (***), $p < 0.01$ (**), $p < 0.05$ (*).

Hypotheses 1–3 proposed above were tested according to the results of the path coefficient significance test. For the specific results, see Table 12.

Table 12. Model hypothesis examination.

Research Hypothesis	Hypothesis Test
Hypothesis 1. *The paradox cognition of industrial units has a positive and significant impact on green production management.*	Valid
Hypothesis 2. *The paradox cognition of industrial units has a positive and significant impact on green production technology.*	Valid
Hypothesis 3. *The paradox cognition of industrial units has a positive and significant impact on green product supply.*	Valid

According to Table 12, assuming 1–3 are all true, the above results show that paradox cognition can significantly stimulate the industrial green production behavior of enterprises. The industrial green production behavior includes not only the provision of green products, but also green production technology and green production management. According to Table 10, the effect of paradox cognition on green production management, green production technology, and green product provision are 0.587, 0.417 and 0.728 respectively. It can be seen that paradox cognition has the most significant impact on the provision of green products, followed by the impact on green production management and green production technology.

5.4. Mediation Effect Analysis

In recent years, a growing number of literature publications concerning sociology and psychology tend to conduct indirect relationship analysis between variables through the mediation effect. As a result, the number of analyses employing the mediation effect model has increased. According to statistics from Rucker [37] and others, during 2005 and 2009, the mediation effect was used by 59% of articles published in the *Journal of Personality* and 65% of those published in *the Journal of Personality and Social Psychology* (JPSP). Simultaneously, domestic sociological articles regarding mediating effects have also increased year by year. The mediation effect test can verify the process and effect of an independent variable on a dependent variable. Thus, compared with the path coefficient test, it focuses more on explaining how and why variables influence each other. The gradual regression coefficient test, which is usually called the stepwise test, is the most popular method of mediation effect testing. Yet, it has been increasingly criticized and questioned in recent years [38–40]. Therefore, it is recommended to use the Bootstrap method, which is generally considered to be better, to directly check the salience of coefficient products. Without requiring the data to conform to a normal distribution, the method is more in line with the actual situation. Therefore, in this paper, a non-parametric percentile Bootstrap method with bias correction is used in the mediation effect test.

As shown in Figure 1 (theoretical model of the impact mechanism of paradox cognition and green industrial production on corporate performance), the bootstrap test method for the mediation effect of these six paths is given below (Table 13).

Table 13. Mediation paths of the theoretical model.

Mediation Path
Path 1: Paradox Cognition → Green Production Management → Corporate Financial Performance
Path 2: Paradox Cognition → Green Production Management → Corporate Potential Performance → Corporate Financial Performance
Path 3: Paradox Cognition → Green Production Technology → Corporate Financial Performance
Path 4: Paradox Cognition → Green Production Technology → Corporate Potential Performance → Corporate Financial Performance
Path 5: Paradox Cognition → Green Product Supply → Corporate Financial Performance
Path 6: Paradox Cognition → Green Product Supply → Corporate Potential Performance → Corporate Financial Performance

According to the mediation effect test (Table 14), the mediation effects of two paths, namely path 1 and path 3, were not significant. Both the bias-corrected and percentile minimum values of these two paths contained zero, indicating no mediation effect of these two paths. Secondly, the mediation effects of path 2 and path 4 were very weak. It was thus concluded:

Table 14. Mediation effect test.

SIE—Specific Indirect Effects	Point Estimate	Product of Coefficients		Bias-Corrected 95% CI		Percentile 95% CI	
		Standard Error	Z Value	Lower	Upper	Lower	Upper
Path 1	0.005	0.036	0.139	−0.063	0.076	−0.058	0.083
Path 2	0.031	0.019	1.632	0.003	0.083	0	0.077
Path 3	0.038	0.037	1.027	−0.011	0.147	−0.017	0.13
Path 4	0.036	0.022	1.636	0.008	0.092	0.008	0.091
Path 5	0.238	0.095	2.505	0.059	0.429	0.047	0.424
Path 6	0.183	0.072	2.542	0.062	0.362	0.056	0.334

Note: CI represents confidence interval; samples were obtained by 1000 repetitions of bootstrap.

The mediation effects of Path 1 and Path 3 were not significant, indicating that paradox cognition cannot directly improve corporate financial performance by affecting green production management and green production technology. It can be seen from Table 11 (path coefficient table of the theoretical model) that the paths are not significant since the impact of green product supply and green production management on corporate financial performance does not exist. It can be seen that although paradox cognition can simultaneously stimulate green product supply as well as the employment of green production technology and implementation of green production management, neither can directly contribute to improved corporate financial performance.

Mediation effects of both Path 2 and Path 4 were observed, but neither presented great significance. It can be seen from Table 11 (path coefficient table of the theoretical model) that they are not significant since only tiny impacts of green product technology and green production management on corporate financial performance exist. It can be seen that paradox cognition can stimulate green product supply as well as the employment of both green production technology and green production management, of which both may contribute proportionally to improved corporate potential performance, which enhances financial performance. In other words, companies may improve their potential performance through green production management and green production technologies, thereby indirectly improving their financial performance.

According to the mediation effect table (Table 14), significant mediation effects were shown by two mediating variables, namely, Path 5 and Path 6. The Z values of both the two paths were above 1.96, proving significant mediation effects of the two paths. This led to the following conclusions: first, green product supply can be significantly stimulated by paradox cognition, as evidenced by the greater impact of green product supply compared to both green production management and green production technology in Table 11 (path coefficient table of the theoretical model). Second, corporate potential performance and financial performance can be improved by paradox cognition with its influences on green product provisioning supply, meaning that green product supply can simultaneously improve the potential performance and the financial performance.

In summary, it can be seen from the mediation effects of the model that: first, although paradox cognition can simultaneously stimulate green product supply as well as the employment of green production technology and the implementation of green production management, green production management and green production technology cannot directly contribute to improved corporate financial performance. Second, companies can improve their potential performance through green production management and green production technologies, thereby indirectly improving their financial performance. Third, corporate potential performance and financial performance can be enhanced by

paradox cognition with its influences on green product provisioning supply, meaning that green product supply can simultaneously indirectly enhance corporate financial performance through its reinforcement of corporate potential performance while also directly improving its financial performance.

6. Discussion

Based on the paradox theory, a model of the relationship between paradox cognition, industrial green production, and enterprise performance has been constructed in this paper. It mainly studies whether paradox cognition can positively affect the green production behavior of industrial enterprises, and thus improve the economic interests of enterprises. Based on the survey of 305 samples, the mutual relationship between paradox cognition, green product supply, green production technology, green production management, potential performance and financial performance of enterprises has been verified by the structural equation path coefficient and intermediary effect. The results proved the interactions between all the variables in the model. In Figure 1, there are two paths that are not significant: "green production management → enterprise financial performance" and "green production technology → enterprise financial performance". So, the two paths were deleted in the model. As shown in Figure 4, the paths listed in Figure 4 are all significant and proved influential paths.

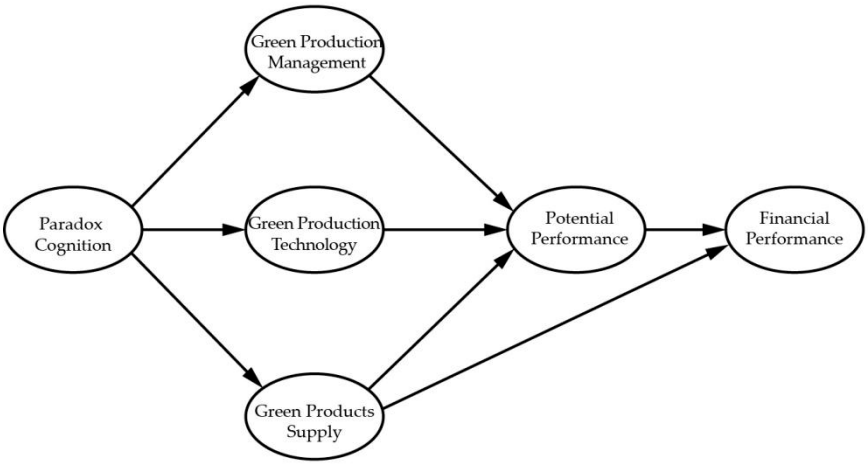

Figure 4. Revised theoretical model of the impact mechanism of paradox cognition and green industrial production on corporate performance.

6.1. Research Conclusion

According to the confirmed theoretical model (Figure 4), the following research conclusions can be made. Firstly, paradox cognition has a positive and significant impact on green industrial production, which includes green product provision, green production technology and green production management. Secondly, paradox cognition has the most significant impact on the provision of green products followed by green production management, and green production technology successively. Thirdly, paradox cognition can improve the potential performance of enterprises by affecting "green product provision", "green production management" and "green production technology", and then indirectly improve the financial performance of enterprises.

6.2. Suggestions and Applications

According to the above conclusions, it can be seen that paradox cognition has a significant impact on industrial green production behavior. Thus, the reason why enterprises refuse to implement green production in industry is explained from a cognitive point of view. Although many countries have issued policies to encourage enterprises to implement green production, the effect has not been significant. One of the most important reasons for this is that most of these policies originate from outside of the enterprises, encouraging them to implement green production in different ways.

However, the enterprises do not have such paradox cognition as they can only see the contradiction between their economic benefits and environmental benefits, while neglecting the relationship between the two. The higher the cognitive level of the enterprise, the greater the probability of them implementing industrial green production behavior, and the greater the possibility for them to take both environmental benefits and enterprise economic benefits into consideration. Therefore, from the government's point of view, it is necessary to popularize the paradoxical cognitive level of enterprises.

Secondly, paradox cognition can improve the potential performance of enterprises by affecting "green product provision", "green production management", and "green production technology", and then indirectly improve the financial performance of enterprises. This shows that although the paradox cognition can stimulate green industrial production, the industrial green production behavior cannot bring financial performance to enterprises directly. It will have a positive impact on the potential performance of enterprises, and then indirectly improve the financial performance of enterprises. For industrial enterprises, the implementation of green production can help the enterprises to enhance their image and reputation, improve their innovation ability and the efficiency of resource utilization, while those factors will greatly improve the financial performance of enterprises.

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