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Research on the dual-path between green innovation strategy and Enterprise Performance--The mediating role of green image and competitive edge

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Abstract: *A novel way to achieving sustainable development and an unavoidable option for enterprise transformation and upgrade— green innovation strategy. However, little research focuses on the formation mechanism between the implementation of green innovation strategy and enterprise performance. This research work constructs a dual-path model to test the effect of green innovation strategy on enterprise performance. This study puts forward hypotheses and tests them by hierarchical regression and bootstrap test. The findings show that a green innovation strategy has significantly stimulate enterprise performance, assist companies in establishing a positive green image, and enhance their competitive edge. When it comes to the correlation between green innovation strategy and enterprise performance (e.g. market success and financial performance), the mediating role in terms of image and competitive edge is credible, which provides significant enlightenment for enterprises' green practices.*

Keywords: *Green innovation strategy, market success, financial performance, green image, competitive edge*

1. Introduction

In recent years, national strategies for resource conservation and environmental protection have been launched one after another, and enterprises as economic micro-entities are not immune to them. On the one hand, enterprises' business activities are limited by the limited nature of the natural environment, such as increasingly stringent environmental regulations and resource constraints, which reflect the need to implement green innovation strategies. On the other hand, in the relationship between various enterprise stakeholders, the growing concerns with environmental preservation and customer readiness to pay a green premium price, which also reflect the importance of implementing green innovation strategies. For corporations, figuring out how to accomplish a 'win-win' scenario between environmental preservation and economic growth has become a strategic decision. Exploring how green innovation affects business performance is therefore essential to guide business practice.

What variables are critical role in the facilitation mechanism of green innovation strategies and company merits? At the moment, there isn't much study being done in this field. The green image may fully integrate internal resources while also leveraging external resources to gain a complementary advantage. Green innovation, in addition, is compatible with sustainability goals and provides organizations with more competitive advantages owing to organizational legitimacy. Following a review of some pertinent literature, this study seeks to answer two important questions: (1) Can green innovation strategies improve corporate performance? (2) What factors influence how green innovation strategies impact enterprise performance? This study builds a model that illuminates the influence of green innovation strategy on firm performance and investigates the mechanism of green innovation strategy influence on company performance via green image and competitive edge.

2. Literature Review and Hypotheses

2.1. Green Innovation Strategy

On the basis of environmental strategy Research, the concept of green innovation strategy that had come up based on academic and practical demands. Scholars have divided types of environmental

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strategies: Response strategies, protective strategies, adaptive strategies, and active strategies are the four types of methods used by businesses in response to environmental challenges, according to Henrique (1999) and others[7]. In current studies, the green innovation strategy often refers to the active environmental strategy. Buysse (2003) and others divided environmental strategies into three types: reaction, pollutant prevention and environmental leadership[8]. Despite their differences, the types are categorised depending on how enterprises react to environmental problems. The environmental innovation approach, according to Eiadat et al.(2008), is the process of lowering sources of pollutants, controlling and managing pollution, implementing environmental management systems, and implementing substantial organizational reforms[1].

In this paper, green innovation strategy refers to changing or improving business activities such as processes of production or business management and incorporating environmental responsibility into strategic planning strategies methods to decrease enterprises' negative environmental effect and accomplish the objective of integrated environmental and economic development[1].

2.2. Green Innovation Strategy and Enterprise Performance

His study combs the relevant literature of scholars at home and abroad in view of the research goal. Previous studies have shown that there has always been controversy about the research on green innovation strategy and enterprise performance, and whether the cost of green innovation can be compensated through environmental advantages that is the debate's focal point. The traditional view that the cost of green innovation cannot be compensated by environmental protection benefits such as energy conservation, consumption reduction and productivity improvement, and takes the cost benefit as the main source of enterprise performance[2,9]. Another view held by some scholars is that the increased resource utilization and new profit points brought about by green innovation can offset the cost of green innovation and obtain more competitive edges and benefits[2,10]. For one thing, green innovation strategies implemented by businesses can reduce pollution emissions and energy consumption, and green process innovation, for example, can optimize production processes, increase production efficiency, and lower production costs[12]. Secondly, enterprises implement green innovation strategy and innovate green products to meet the green needs of consumers, so as to obtain green premium and differentiation advantages[13], and finally improve enterprise performance.

The enterprise's performance effect also represents the company's internal operational state as well as the external market environment's performance. It can be measured by multiple comprehensive indicators, such as customer satisfaction, market share and corporate profit growth rate. Llach and Perramon’s (2013) research is used in this study[22], which divides the performance of enterprises into two parts: financial performance and market success. The green innovation strategy is thought to perform a facilitative role in improving company performance. Accordingly, the trying to follow are the paper’s hypotheses:

H1a: Green innovation strategy significantly promotes market success

H1b: Green innovation strategy significantly promotes financial performance.

2.3. The Mediating Role of Green Image

Enterprise green image is a cognition, evaluation, emotion, and association method of stakeholders’ environmental behavior, which are measured based on the green reputation and credibility of the enterprise [21]. For one thing, green innovation strategy execution may reduce the occurrence of environmental accidents and the harm to the natural environment. secondly, it can better capable of meeting of the demands of the green market. In addition, it can obtain greater social recognition and legitimacy, and win the support of more stakeholders.

Green image is an invisible positive publicity that distinguish between enterprises and counterpart competitors to promote the improvement of enterprise performance. A good green image can obtain more policy support and positive publicity resources, win more consumer support, and form a green product premium and brand reputation.

By implementing a green innovation strategy, enterprises can strengthen their green image. A good green image helps enterprises acquire government resources, enhance customer purchase intent, improve staff happiness, enabling businesses to gain green competitive edges, and ultimately improve enterprise merits. Accordingly, the trying to follow are the paper’s hypotheses:

H2: Green innovation strategy significantly promotes green image.

ISSN 2616-5902 Vol. 4, Issue 19: 64-72, DOI: 10.25236/AJBM.2022.041909

H3: Green image mediates the relationship between green innovation strategy and market success (3a) and financial performance (3b).

2.4. The Mediating Role of Competitive Edge

From the perspective of the basic characteristics of the competitive advantage of an enterprise, a higher competitive advantage means that an enterprise has higher product pricing power in the market and has a greater chance of obtaining excess profits. Based on the customer value basic view, it can be known that enterprises have to create unique value for customers to maintain their own competitive edges. By this way, companies can be motivated to carry out innovative activities and expand reproduction, Then, to maintain product competitiveness, and last, to improve the performance of the enterprise. In recent years, scholars have found that green technology innovation is conducive to cultivating and expanding competitive edges of enterprises [24]. The implementation of green innovation strategy obtains competitive edge by obtaining direct or indirect benefits. Direct benefits to enterprises include operational advantages, reduced costs, for example, can be achieved through improved resource efficiency and better distribution. Improved image; improved relationships with customers, suppliers, and competent departments; and increased employee satisfaction in health and safety are all indirect benefits to the enterprise.

The enhancement of enterprise competitive advantage can effectively promote the improvement of enterprise performance: First, the main business of enterprises with strong competitive advantage has outstanding profitability, which is more conducive to the accumulation of excess profits. Second, when the competitive advantage of enterprises is more prominent, the ability to market products and create brands will be improved, and customer loyalty will be improved. Third, enterprises with outstanding competition tend to attract excellent talents, which makes enterprises have higher ability to bear risks and effectively improve enterprise performance. Fourth, when enterprises have certain competitive advantages, in order to maintain a stable source of profits, enterprises need to constantly explore new sources of competitiveness, so as to enhance the expansion power of enterprises. In addition, due to the market demand, companies also continue to expand production scale, and ultimately achieve performance improvement. Accordingly, the trying to follow are the paper's hypotheses, as shown in Figure 1:

H4: Green innovation strategy significantly promotes competitive edge.

H5: Competitive edge mediates the relationship between green innovation strategy and market success (5a) and financial performance (5b).

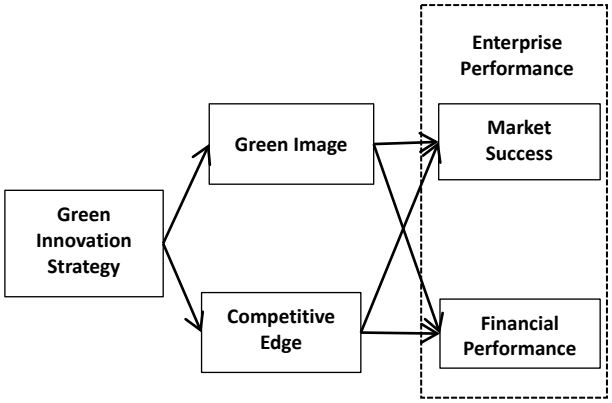

Figure 1: Theoretical Model

3. Research Design

3.1. Data Sources and Research Samples

In this study, the electronic version of the questionnaire was established, which was mainly completed by students with close personal relationships, and was entrusted to further expand the distribution channels through the direct line senior brothers and sisters. In addition, relying on the online platform, the questionnaire was distributed to ensure the consistency between the research object and the goal through the restriction of sample characteristics and the setting of each link. Through the above methods,

ISSN 2616-5902 Vol. 4, Issue 19: 64-72, DOI: 10.25236/AJBM.2022.041909

the questionnaire survey will be mainly completed from March 2022 to the mid of April 2022. 118 questionnaires will be recovered offline and 235 questionnaires will be recovered online (86 of which have been rejected automatically after the screening questions have been eliminated), a total of 353 questionnaires will be recovered. After re screening and eliminating the continuous repeated options and regularly answering the questionnaire, finally, 263 valid surveys were acquired, and the questionnaire's effective rate was 74.5%. Table I summarizes the fundamental characteristics of the survey object:

Table 1: Descriptive Statistics

Variables	Symbol	Percentage(%)	Variables	Symbol	Percentage(%)
Number of employees	Under 100	7.83%	Age	Under 30	28.89%
	100-200	30.12%		30-39	54.67%
	201-500	24.1%		40-49	16.12%
	5001-1000	19.88%		Over 50	0.32%
	Over 1000	18.07%	Education	High school and below	3.61%
Industry	Traditional manufacturing	38.53%		Undergraduate	11.45%
	High tech industry	17.45%		Bachelor	60.24%
	Other	44.02%		Master	21.69%
Enterprise years	Under 3	3.67%		Doctor or above	3.01%
	3-5	13.49%	Position	Senior managers	9.64%
	6-10	38.12%		Middle managers	21.8%
	11-15	28.87%		First-line managers	22.89%
	Over 16	15.85%		Employees	45.67%
Gender	Female	53.61%			
	Male	46.39%			

3.2. Variable Measurement

The measurement scales of the main variables in this study were referenced from relevant domestic and international studies, with appropriate modifications. All question items were scored using the Likert 7 scale.

(1) The Independent Variable

Green Innovation Strategy (GIS). Referring to Chan's study (2005), 7 questions including: "Adjusted operations to reduce ecological damage (Q8)", "Proactive environmental remediation actions are taken (Q9), "Operations have been modified to decrease resource waste and pollution outputs. (Q10)", " Non-recycled raw materials, pharmaceuticals, and solid wastes are all recycled (Q11)", " Operations have been modified to decrease the environmental effect of production (Q12)", "Proactive measures are taken to reduce energy consumption in production (Q13)", "Traditional energy sources are replaced by new, less polluting sources (Q14)"[20].

(2) Mediating Variables

Green Image(GI) and Competitive Edge(CE); The former includes 6 questions: "The company's environmental management practices are professional(Q15)", "The company has a deep understanding of environmental management(Q16)", " The company's environment protection reputation is solid(Q17)", "The firm is trusted with environmental protection(Q18)", "The company takes customer perceptions into account when conducting environmental management(Q19)", "The enterprise is regarded as a benchmark for best environmental management(Q20)". The latter includes 4 questions: "Companies execute operational processes faster and in a more efficient manner(Q21)", "Ability to adapt more flexibly to rapid changes in the market(Q22)", "More features and better performance of products and services for customers(Q23)" and "Companies are more focused on the diverse needs of customers(Q24)"[15,22].

(3) Dependent Variables

ISSN 2616-5902 Vol. 4, Issue 19: 64-72, DOI: 10.25236/AJBM.2022.041909

Market Success (MS) and Financial Performance(FP); The former includes 2 questions: “Company image improved(Q25)”, “Customer satisfaction improved(Q26)”. The latter includes 4 questions: “Company sales revenue increased (Q27)”, “The company's profit before tax increased(Q28)”, “The company's market share increased (Q29)”[23].

(4) Control Variables:

Other considerations, particularly the age of the company, enterprise size, employee age, education and position, should be taken into account, which is control variables in this study.

3.3. Reliability and Validity

To test the reliability and validity of all the variables in this study, this paper used SPPS 24.0 and AMOS 23.0. Table 2 shows the data result. Cronbach's coefficients, as in many other research, were employed to assess reliability. The Cronbach’s α for variable in the table both are larger than 0.8, and the lowest value for all factor loadings of the variables is 0.8. At the same time, the CR values for these five variables are 0.958, 0.969, 0.973, 0.920, and 0.962 respectively. These data validates the dependability of all variables in this study. Therefore, the questionnaire are acceptable.

Furthermore, the findings of the data analysis showed that the AVE values of both are larger than 0.6. As shown by the data results: ($\chi 2$/ df = 1.519, CFI = 0.93, RMSEA =0.049, IFI = 0.919, TLI = 0.91). This collection of data demonstrates that the model is well-fitting.

Table 2: Results of Factor Analysis

Variables	Question	Factor Loading	Cronbach’s α	CR	AVE
GIS	8	0.87	0.928	0.958	0.822
	9	0.85			
	10	0.84			
	11	0.83			
	12	0.83			
	13	0.82			
	14	0.80			
GI	15	0.91	0.936	0.969	0.875
	16	0.91			
	17	0.93			
	18	0.92			
	19	0.91			
	20	0.92			
CE	21	0.91	0.938	0.973	0.839
	22	0.92			
	23	0.92			
	24	0.93			
MS	25	0.88	0.868	0.92	0.754
	26	0.86			
FP	27	0.94	0.93	0.962	0.884
	28	0.94			
	29	0.93			

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

3.4. Descriptive Statistics and Correlation Analysis

Table III shows the data results, green innovation strategy positively relationship to market success, financial performance, green image and competitive edge. The correlation coefficients are 0.347, 0.396, 0.582 and 0.592. Green image positively relates to market success and financial performance. The correlation coefficients are 0.396 and 0.347. Competitive edge positively relates to market success and financial performance. The correlation coefficients are 0.426 and 0.447. The findings confirm the study hypothesis and give evidence for future empirical testing.

ISSN 2616-5902 Vol. 4, Issue 19: 64-72, DOI: 10.25236/AJBM.2022.041909

Table 3: Means, standard deviations, and correlation

Variables	Mean	S.D.	1	2	3	4
1. GIS	3.65	1.447				
2. GI	4.23	1.950	0.582***			
3. CE	4.49	1.871	0.592***	0.567***		
4. MS	4.02	1.956	0.347***	0.387***	0.426***	
5. FP	3.73	1.848	0.396***	0.426***	0.447***	0.457***

Notes: ***p<0.001, **p<0.01, *p<0.05.

3.5. Hypothesis Testing

The data in this study was analyzed using SPSS24.0, and the bootstrapping approach was employed to assess the intermediate effect. All the results are shown in Tables IV-VI. Model 2 of Table IV demonstrates that, Adopting a green innovation strategy significantly promoted market success (β = 0.337, $p < 0.001$). Consequently, Hypothesis 1a was supported. As shown in Model 8 of Table V, the implementation of a green innovation strategy positively affected on financial performance ($\beta = 0.393$, $p < 0.001$), thus H1b is supported. As shown in Model 14 and 16 in Table VI, green innovation strategy significantly promoted green image ($\beta = 0.594$, $p < 0.001$) and competitive edge($\beta = 0.591$, $p < 0.001$), in other words, H2 and H4 are supported. Meanwhile, after adding the mediating variable green image, as shown in Model 2and 4, the coefficient of green innovation strategy to market success becomes smaller significantly, from 0.337 to 0.162. The coefficient of green innovation strategy to financial performance becomes smaller significantly, from 0.393 to 0.189 as shown in Model 8and Model 10. As a result, the relationship between green innovation strategy and market success and financial performance is partially mediated by green image. H3a and 3b are supported. After adding the mediating variable competitive edge, as shown in Model 2and 6, The coefficient of the effect of green innovation strategy on market success changed from significant to insignificant, from 0.337to 0.124. As shown in Model 8 and 12, the coefficient of green innovation strategy to financial performance becomes smaller significantly, from 0.393 to 0.182. The findings indicate that competitive edge serves as a mediator in the variables studied in this paper. H5a and H5b are supported.

To further verify whether the intermediary function of green image and competitive edge is significant, for the Bootstrap test, AMOS is employed. As shown Table VII, a sample size of 2000 was set at 95% confidence interval. The mediating effect values of 0.254 [0.148, 0.359] and 0.267 [0.179, 0.354] not including 0 were obtained for green image, respectively, with significant mediating effects. The mediating effect values for competitive edge were 0.268 [0.181, 0.355] and 0.255 [0.150, 0.360] not including 0, with significant mediating effects. Hypothesis 3a, Hypothesis 3b, Hypothesis 5a and Hypothesis 5b are supported.

Table 4: The regression Analysis of Market Success

Variables	MS					
	M1	M2	M3	M4	M5	M6
Number of employees	-0.091	-0.065	-0.081	-0.071	-0.099	-0.088
Stage of development	0.103	0.079	0.098	0.085	0.094	0.046
Age	0.006	0.038	-0.028	-0.041	-0.029	-0.039
Education	-0.089	-0.125*	0.091	-0.0108	-0.087	0.101
Position	-0.07	-0.06	-0.104	-0.094	-0.122*	-0.11
GIS		0.337***		0.162*		0.124
GI			0.385***	0.293***		
CE					0.429***	0.356***
R^2	0.054	0.159***	0.199***	0.215***	0.229***	0.238***
F	2.430	6.909***	9.050***	8.702***	10.807***	9.927***
Adjusted R^2	0.032	0.136***	0.177***	0.19***	0.208***	0.214***

Notes: ***p<0.001, **p<0.01, *p<0.05.

ISSN 2616-5902 Vol. 4, Issue 19: 64-72, DOI: 10.25236/AJBM.2022.041909

Table 5: The Regression Analysis of Fianncial Performance

Variables	FP					
	M7	M8	M9	M10	M11	M12
Number of employees	-0.02	0.009	-0.009	0.003	-0.029	-0.013
Stage of development	0.06	0.021	0.043	0.028	0.01	0.012
Age	0.013	0.038	-0.027	-0.042	-0.022	-0.039
Education	0.021	-0.21	0.091	-0.001	0.023	0.003
Position	-0.086	-0.081	-0.126*	-0.114*	-0.142	-0.127
GIS		0.393***		0.189**		0.182**
GI			0.449***	0.341***		
CE					0.461***	0.354***
R^2	0.025	0.168***	0.222***	0.244***	0.226***	0.246***
F	1.073	7.38***	10.398***	10.255***	10.641***	10.372***
Adjusted R^2	0.002	0.146***	0.201***	0.22***	0.205***	0.222***

Notes: ***p<0.001, **p<0.01, *p<0.05.

Table 6: The Regression Analysis of Green Image and Competitive Edge

Variables	GI		CE	
	M13	M14	M15	M16
Number of employees	-0.025	0.019	0.020	0.064
Stage of development	0.043	0.024	0.155	0.089
Age	0.133	0.013	0.081	0.005
Education	0.001*	-0.055	-0.007	-0.062
Position	0.092	0.094	0.123	0.125
GIS		0.594***		0.591***
R^2	0.018	0.35***	0.049	0.279***
F	1.095	22.979***	2.677*	15.295***
Adjusted R^2	0.008	0.327***	0.017	0.264***

Notes: ***p<0.001, **p<0.01, *p<0.05.

Table 7: Bootstrap Test for the Significance of Mediating Effect

Path	Effect	95% confidence interval	
		Lower limit	Upper limit
GIS—GI—MS	0.254	0.148	0.359
GIS—GI—FP	0.267	0.179	0.354
GIS—CE—MS	0.268	0.181	0.355
GIS—CE—FP	0.255	0.150	0.360

4. Conclusions and Enlighement

4.1. Discussion

In recent years, national strategies to conserve resources and protect the environment have been introduced one after another, and it is crucial for enterprises, as economic micro-entities, to explore how green innovation affects corporate performance. Based on the resource-based view, hierarchical regression and Bootstrap tests, the influence mechanism of green innovation strategy on enterprise performance (e.g. market success and financial performance) is discussed in this paper, and the mediating role of green image and competitive edge, and the hypotheses in the study are all validly tested, As a result, the following conclusions are drawn.

(1) There was a significant positive correlation between green innovation strategy and enterprise performance (e.g. market success and financial performance), while promoting a good green image and gaining direct or indirect benefits to achieve a competitive edge.

A new way to achieve enterprise performance growth is to actively implement the green innovation strategy. Although it requires significant investment in resources and technology in the early stages, it

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has a significant impact on enterprise performance, which is a strong response to the concerns expressed about the negative impact of the implementation of green innovation strategies on enterprise merits. On the one hand, the costs of green production and pollution control brought about by put into effect of green innovation strategies may be beneficially compensated by the enhancement of green image. On the other hand, green innovation strategies also create new green opportunities, transforming the green advantages of enterprises into economic advantages and enhancing their competitive edges. Thus, in the new era of "green development", enterprises should be encouraged to take the main responsibility for environmental protection and put into effect green innovation strategies to improve their performance.

(2) Our work finds that green image and competitive edge play a mediating role. This suggests that green innovation strategy affect enterprise performance through green image and competitive edge. For one thing, the implementation of green innovation strategy is conducive to the establishment and enhancement of the green image of enterprises, which improves the satisfaction of stakeholders and earns them a good reputation, thus enabling them to gain a first-mover advantage in the market competition, which in turn leads to better financial performance. For another, the implementation of a green innovation strategy allows companies to acquire a competitive edge by being the first to market and remuneration for innovation by cultivating unique core competencies that are not easily imitated, which in turn gives them a competitive edge and contributes to the development of enterprise performance.

4.2. Limitations and Future Directions

To begin, the study of variables that are green innovation strategy and corporate performance is a static study based on questionnaire data which may lead to a tentative causal relationship. Future studies can use panel data to validate to increase the stability of the findings. Secondly, this study simply divides corporate performance into two dimensions: market success and financial performance, and whether there is a sequential promotion effect between these two dimensions can be further explored. Thirdly, this study fails to compare the differences in impact between different regions and industries, which can be further explored in future studies. Future study could take some new energy or industries into consideration, where companies in such industries have the characteristics of actively pursuing the development of green innovation strategies, and their awareness and attention to environmental issues are higher. Therefore, they are more motivated to implement green innovation strategies.

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