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Assessing the Mediating Role of Environmental Policy through the Lens of Merger and Acquisitions for Sustainable Environment

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ABSTRACT

Sustainability in the environment could be seen as interfering with economic growth. When it comes to resource allocation through economic operations like mergers and acquisitions, environmental policy is crucial for promoting environmental sustainability. This study explores the environmental policy-based process by which mergers and acquisitions affect sustainable environmental development. We demonstrate how mergers and acquisitions have a significant beneficial impact on environmental sustainability using panel data of the Chinese listed companies. The study shows that environmental policy when mediating environmental sustainability and mergers and acquisitions enhances the environmental structure of a firm and leads to improving environmental sustainability. In turn, this effect can improve business management in several areas, particularly in sustainable environmental development. Considering these results, this study suggests that the government may enhance the role of environmental policy by encouraging firms to use environmentally friendly resources through mergers and acquisitions, which will promote and protect environmental sustainability.

1. Introduction

Environmental policy has spent decades working to increase environmental sustainability, for instance by reaching carbon neutrality and energy efficiency. The conflict between economic activity and environmental sustainability may always exist. To achieve sustainable development, economic, environmental and social values should be balanced (Janet & Gary, 2017). The performance of an organization or society may be measured using a new assessment method that considers company behavior from three perspectives such as the economic, ecological, and social environment. Furthermore, Schippe and Thompson (2006) shows that mergers and acquisitions

(M&A) activity is a significant economic activity with a significant impact on enterprise success both socially and economically.

Conflicting interests do arise between economic, social, and environmental goals. As a result, since there is no overarching optimizing criterion available, it would be difficult for a company to harmonize all three dimensions of wellbeing. The Chinese government has recently placed increased emphasis on environmental conservation. Currently, the Chinese government is heavily focused on meeting the carbon neutrality objective (Koondhar et al., 2021). As a result, we use companies in the manufacturing sector as our sample since they produce large levels of pollution and are more concerned with protecting the environment. Transactions involving mergers and acquisitions are examples of strategic choices that add up to substantial values on a global scale, including both in terms of the volume of transactions and their dollar worth. We discovered an enhanced trend of corporations within pharmaceutical sector toward these development strategies after analyzing the areas of activity. The main goals of these transactions involve reinforcing operational processes, expanding presence in primary and secondary markets, growing presence in new geographic areas, creating synergies, removing duplicate services, rising shareholder value, utilizing sound investment opportunities, providing new products and services, gaining the technological and strategic assets of rivals, and gaining financial advantages.

Environment-friendly development and the smooth transition to a sustainable energy system depend on environmental regulations (Drobetz & Paul, 2020). These laws can aid in addressing some of the biggest environmental and societal problems that the world is currently experiencing, including biodiversity loss, air and water pollution, and climate change (Ibrahim & Ajide, 2021). The execution of these policies can also affect how well business functions, societal justice, and individual behavior in both positive and negative ways. Positively, effective environmental policies can open new business possibilities in the industrial sector, bringing in revenue and bolstering nearby establishments. Policies like feed-in tariffs and tax breaks for installing green energy sources, for instance, can entice businesses to engage in sustainable technologies and foster innovation in the clean energy sector (Shao et al., 2021). Furthermore, by lowering air and water pollution and minimizing the effects of climate change, environmental measures can result in better public health results.

The impact of environmental policies on M&A has received extensive research (Dechezleprêtre & Sato, 2017). Research on the environmental and energy performance assessment of China Coal centered on five-dimensional balanced scorecard however, the effect of M&A on sustainable

development is still not sufficiently understood. As a result, in this study, we want to investigate two research issues. Secondly, can M&A in extremely polluting businesses, notably the mining and manufacturing industries, be useful for sustainable development? If so, is this enhanced sustainability made possible by M&A that strengthens environmental policies? We study the influence of M&A in relation to three aspects: corporation cost to the environment, corporate environmental policy, and environmental performance to closely examine how they affect sustainable environmental development. We specifically have three direct measures of environmental protection, namely environmental performance, evaluated by whether the company releases a major pollutant, environmental policy, measured by whether a firm follows Environmental Policy Stringency index, and environmental cost, measured by total energy consumption. The other factor, green innovations are measured by the techniques firms are using to reduce non-renewable energy usage, are indirect indicators of environmental protection. The first aspect of environmental performance is efforts to lessen negative effects on the outside environment. Environmental cost is the price of ecosystem services deteriorating because of economic activity-related environmental damage. It is the sum of the costs necessary to resolve ecological harm and environmental degradation caused by resource extraction, production, transportation, and other factors (You & Zhang, 2020).

According to Ke and Ai (2020), the company's environmental responsibility evaluation method is broken down into economic, social, environmental, legal, charity, and other duties. A theoretical model of social responsibility for companies is developed by (Li & Xiao, 2009 which is based on the viewpoint of stakeholders. They discover that stakeholder concerns have expanded to include corporate social responsibility as well as the standard of information disclosure, rather than being restricted to financial information like profitability. Social reputation may boost influence and competitiveness through prospective market channels in the more competitive capital market (Zhang et al., 2012). Moreover, utilizing a sizable sample merger in the US, Tang (2020) investigate the connection between corporate social responsibility and M&A. The businesses will take a more active role in environmental protection to achieve greater CSR performance. According to Deng et al. (2012), M&A and R&D help the company's environmental initiatives, which are also linked to CSR. By using bootstrap-based conditional Logit models, researchers also look at how risk in merger and acquisition choices and the growth of the firm are affected by corporate social responsibility (CSR).

Environmental standards compliance, pollution control, and ecological protection are taken into consideration in credit operations, and funds are allocated to sectors and businesses that oversee environmental protection in the interests of environmental sustainability (Peng et al., 2018). According to the study "Does corporate governance work on improving the core competencies of manufacturing firms" by (Ding & Hu, 2020), "Green Credit" refers to the preferential policies that offer projects with environmental sustainability that adhere to standards of environmental protection. Many studies have examined how M&A affects a company's environmental performance as well as the corporate governance they provide. The first goal of this exploratory study is to add to the existing M&A literature by examining the effects of M&A & corporate governance on the development of environmental sustainability. The second is that the performance measurement technique considers both the financial and non-financial aspects of performance. Finally, this study considers an entire manufacturing industry, without any geographical restrictions, in addition to prior studies.

Further, this study adds the following contributions to current literature that uses empirical analysis. First, we examine how M&As in China's high-pollution industries affect environmental sustainability. More significantly, we show how environmental policy mediates the relationship between mergers and acquisitions for environmental sustainability in high-pollution industries. Lastly, we do a robust test by substituting actual mergers and acquisitions with environmental policy for the M&A dummy variable. Based on this, we further investigate how environmental policy influences the environmental sustainability of the manufacturing sector. Our findings show that environmental policy bridges the gap between M&A and environmental sustainability.

To do this, we organized this article as follows: The paper is divided into five sections: "Literature Review," "data and methodology," "Results, and Discussion" and Conclusions and policy recommendations.

2. Literature Review

M&A are a heavily researched area of finance and relate to a rights transfer based on institutional agreements for corporate control rights. The effect of M&A is strongly connected with the M&A motives, according to existing experts that have studied this topic (Luo et al., 2021). According to Glaister and Ahammad (2010), M&A significantly affects enterprise value, particularly for renewable energy firms, which are thought to provide prospective investment goods. According to Yoo et al. (2013), M&A put businesses in an improved position to fulfill their social and environmental obligations. The impact of M&A on environmental sustainability has been studied

globally, not only in the Chinese context. For example, Kim et al. (2021), use various typical Asian nations as their research sample, including Indonesia and India. According to their research, mergers and acquisitions encourage businesses to file extra green patent applications, making them more environmentally beneficial. Corresponding to this, Stefano et al. (2021) shows through an analysis of all US-based completed M&A operations between 2000 and 2019 that the long-term effects of an M&A operation are positively associated with success in terms of corporate sustainability.

More significantly, several academics have shown that M&A is essential to the shareholders' protection from a variety of angles. Ahiabo et al. (2018) stated that shareholder protections, stock markets, and cross-border mergers demonstrate that through improving corporate governance, cross-border acquisitions and mergers have significantly increased shareholder wealth. They demonstrate that international mergers and acquisitions primarily affect shareholders' protection through absorbing effective legal framework. In addition, Dandapani et al. (2020) states the Shareholder's response to a firm's first international acquisition using US data ranging from January 1980 to June 2016 & research the wealth effects of the strategic choice of a firm to become a multinational firm. Because of the size effect that M&A have, they can enhance business performance by maximizing resource allocation, sharing, and usage (Zhang et al., 2020), stock market yield, and return on equity. Scholars have started to pay attention to alternative performance measures, such environmental performance, in addition to the improvement of the standard financial indicators. The environmental performance of M&A refers to environmental management metrics that indicate the real environmental effects associated with M&A in the context of globalization and industrial chains. Hence, environmental performance is a valid criterion for evaluating the effects of M&As. To lessen environmental pollution, M&A can assist businesses in progressively reorienting the entire production chain towards environmental protection (Hu, 2019) M&A analysis of environmental protection industry. The indicator system for evaluating environmental performance can be divided into six first-level indicators and 32 second-level indicators, with the former along with environmental compliance, environmental operational effectiveness, environmental management performance, environmental control efficiency, and environmental protection expenditure, (Yu & Wang, 2020). We propose the following theory in this context:

Hypothesis-1 Through M&A, firms can improve their environmental performance.

According to the stakeholder hypothesis, stakeholders provide businesses with the essential M&A resources. After M&A, firms should focus more on obtaining the best resource allocation, according to (Mela et al., 2021). There has been a lot of M&A activity, which has led to scale effects that have

improved resource allocation and reduced costs overall, including environmental costs. Environmental cost is the price of the ecosystem services' deterioration because of environmental contamination brought on by human activity. According to Kruse et al. (2022), "Valuation model of strategic M&A: a target company based on environmental cost," this indicator includes all costs associated with ecological devastation and environmental pollution. In particular, the institution of an economic growth framework for businesses to achieve win-win both economically and environmentally outcomes are strongly encouraged by strategic control of company environmental costs and diplomatic control of cost to the environment of Chinese businesses under the method of ecological development (Xie & Wang, 2013).

Most of the research that has already been written on environmental costs concentrates on conventional financial measures such pollution charges in operational costs and long-term prepaid expenses (Pirmana et al., 2021). This covers expenses incurred throughout the course of an activity, not simply at the point where pollution occurs. To that end, we propose the following:

Hypothesis-2 Through M&A, firms can reduce their environmental expenditures.

The M&A wealth effect can be unlocked, and excess profits can be generated to set the stage for the supposition of corporate social responsibility for the environment in the process of M&A expansion for businesses with suitable environmental policies (Cai et al., 2020). According to Zhang et al. (2016), firms may be reorganized through M&A to enhance their configuration, lower pollution occurrences, and improve environmental performance through environmentally friendly internal policies. M&A, when augmented with environmental policies, may also help businesses to gain favor with the public and government authorities. Due to this, these firms may also have greater social obligations, be under less departmental oversight, or even face less foreign investment risk (Basile, 2004). Businesses that engage in M&A, particularly state-owned businesses, are more likely to consider internal environmental policies like environmental conservation in addition to their interest in economic benefits (Saleem et al., 2020). Additionally, researchers have discovered that pollution decreases from M&A can boost profitability, reduce waste, and improve resource utilization and energy efficiency, all of which will enhance environmental performance (Tang et al., 2017). Most articles assess a company's success following an M&A from the standpoint of economic and environmental factors. To determine if environmental sustainability improves when businesses engage in M&A with suitable environmental policies, researchers use factors including governance, pollution taxation, social responsibility ranking, and certain important financial data. We propose the following theory in this context:

Hypthesis-3 Firms that engage in M&A are more eager to commit their resources to environmental obligations, such as negative environmental externalities, which enhances environmental performance.

3. Variables Description and Econometric Methodology

Our study uses panel data on Chinese companies operating in the manufacturing sector from 2000 to 2019 that were listed on the Shenzhen and Shanghai stock markets and focused on environmental sustainability. Companies that get preferential treatment, have insufficient data, or have high values are excluded. So, when Probit model is suitable for data analysis, we use several independent variables to meet our objective.

3.1 Data collection and variable definitions

We use listed Chinese firms in the manufacturing sector for the data analysis to show how M&A when interacting with environmental policies affect China's environment because manufacturing sector contribute significantly to GDP and have a significant environmental impact. A deal including M&A is represented by the variable "M&A," which has a value of 1 when one occurs and a value of 0 otherwise. NIR, or net investment rate, is a term. The growth rate, or "NE," is determined by an increase in net earnings. "ENP" is quantified by the volume of environmental policies within the firm. "EP" stands for environmental performance that is determined by whether the business releases a significant pollutant. The environmental policy, abbreviated as "ENP," is calculated using number of environmental policies within the firm. Environmental pollution or "EP" is assessed by looking at whether a firm discharges a key pollutant. "TEC" stands for total energy consumption as determined by total energy usage. GINN is assessed by the number of reported patents on renewable. The data period, which maximizes data availability across variables, is from 1 January 2000 to 31 December 2019. The data supplier is WIND, and all data is collected on an annual basis. Table 1 lists the variables and definitions.

Table 1: Variables and measures

Category	Variable	Symbol	Formula
Independent variables	Merger and Acquisition	MA	1 in the case of M&A 0 otherwise
	Net Investment	NI	Total investment-depreciation
Control variables	Net Earnings	ER	Growth Rate of Operating Revenue
	Net Profit	NP	TR-TC
Mediator	Environmental Policies	ENP	Volume of environmental Policies

Dependent variables	Whether there is an independent environmental responsibility	ENVR	1 if yes, 0 otherwise
	Total Energy Consumption	TEC	Energy use in equivalent oil consumption
	Green Innovations	GINN	Number of reported patents on renewable energy technologies

Three dependent variables (ENVR, TEC, GINN) & two independent variables (M&A and NI) are included in the panel data sets. M&A serves as the primary explanatory variable, while NI serves as an alternate explained variable for robustness considerations. We choose the variables ER and NP as control variables since they influence sustainable environmental development. As a mediator to show how the independent factors affect the dependent variables, we use ENP and EP. The number of environmental policies and environmental pollution can be a key indicator of a firm's ability to monitor a company's environmental performance (Afshan et al., 2022). Table 2 descriptive statistics for the manufacturing sector.

Table 2: Descriptive statistics

Variable	Observations	Mean	S.Dev.	Min.	Max.
NI	4367	11234	401.004	− 3.457	19,982.972
ER	20032	0.512	14.954	-0.8954	2056.37
NP	20987	3.1507	2.0408	− 2.2410	5.2311
ENP	21278	0.598	0.302	0.007	5.875
TEC	2219	4.03	20.953	- 4.007	2594.890
GINN	1785	9.985	5.082	3	42

Source: Authors own calculation

Although other variables show less volatility, ER and TEC have high volatility and a considerable difference between their minimum and maximum values.

3.2 Methodology

Panel data may be more suited for examining the dynamics of change, according to an analysis of a broad cross section of observations. Panel data can offer additional degrees of freedom, knowledge, variety, and less co-linearity from an econometric standpoint, as well as allowing for individuals extraneous variables (Wooldridge, 2015). As a result, for our inquiry, we employ panel data in this study. There are two types of panel data sets: time series & cross-sectional series. We collect the pertinent corporate data for the manufacturing industries to study based on the industry

classification of the Shenzhen & Shanghai stock exchanges. The company-year series is used. Companies with extreme values & missing data are not included, and all data are organized as per time and business code. We just use Probit model for all these data analysis since some of the dependent variables include dummy variables. A multiple probability ratio regression model is the Probit model. The residual units of a Probit model fit a typical normal distribution, making it a panel data model, a kind of model that is frequently used to estimate a binary criterion variable regression. Its benefits stem from its straightforward design and user-friendly handling (Zhang et al., 2020).

The following equation represents the general model of multiple linear regression:

$$Y=\beta_0+\sum_{i=0}^{n}\beta_i X_i+\varepsilon_i \quad (1)$$

Y is the dependent variable x_i is independent variable and ε_i is the residual term.

The original equation is transformed using the Probit function to examine the link between each explanatory variable and the probability P = P{Y = 1}of M&A increasing environmental sustainability. Considering that $\varphi(x)$ is the normal distribution function,

$$\emptyset^{-1}(P)=\emptyset^{-1}(P\{Y=1\}) =\beta_0+\sum_{i=0}^{n}\beta_i X_i+\varepsilon_i \quad (2)$$

P denotes the probability function, x_i is the explanatory variable and ε_i is the residual error term.

To do multivariable regressions, panel data models are used in this study. We can obtain the following equations from the stated hypotheses:

$$Y(P\{Y=1\}) =\beta_i^t++\sum_{i=0}^{n}\beta_i^t X_i^t + \varepsilon_i \quad (3)$$

P=1 denotes the occurrence of mergers and acquisitions that advance environmental sustainability, and P is the likelihood that M&A will influence environmental sustainability.

3.2.1 Pooled Regression

To examine Hypothesis 2, the additional panel data are used:

$$Y_{1,t=}\alpha_1 + \beta_{TEC1}NP_{(i,t)} + \alpha_{TEC2}ER_{(i,t)} + \alpha_{ETC3}M\&A_{(i,t)} + \varepsilon_1 \quad (4)$$

Where $Y_{1,t}$=TEC, i=manufacturing industry and t is the time.$Y_{1,t}$ represents the environmental cost of the industry affected by the above-mentioned factors in a certain period.

Similarly, we use a pooled model for GINN with the formula given below:

$$Y_{2,t=}\alpha_2 + \beta_{ER1}NP_{(i,t)} + \alpha_{ER2}ER_{(i,t)} + \alpha_{ER3}M\&A_{(i,t)} + \varepsilon_2 \quad (5)$$

Where $Y_{2,t}$=GINN, i=manufacturing industry and t is the time. $Y_{2,t}$ represent the environmental patents of industry affected by the above-mentioned factors in a certain period.

3.2.2. Mediation Regression

The mediation variable ENVP is included in this section to further investigate the impact of M&A on all outcome variables. We examine the same manufacturing firms once more. We use Baron and Kenny (1986), three-step mediation regression approach for the examination of mediating effects. These findings are consistent with Baron and Kenny's first step (1986). Tenth, we carry out the following two stages as given in Eq (9). To further understand the relationship between mediator and dependent variables, we first plot NP and ER, to uncover the relationship between the mediator & explanatory factors, we correlate ENVP with M&A plus control variables. If both regressions provide significant outcomes, then it is plausible that environmental policy can function as a mediator between M&A & environmental sustainability. We also demonstrate that M&A have a favorable impact on environmental sustainability, possibly because of enhanced internal environmental policies following restructuring.

Here is how the model may be specified:

$$Y_{3,t=}\alpha_3 + \beta_{ENVR1}ENVP_{(i,t)} + \varepsilon_3 , \quad (6)$$

$$Y_{4,t=}\alpha_4 + \beta_{TEC1}ENVP_{(i,t)} + \varepsilon_4 \quad (7)$$

$$Y_{5,t=}\alpha_5 + \beta_{GINN1}ENVP_{(i,t)} + \varepsilon_5 \quad (8)$$

$$Y_{6,t=}\alpha_6 + \beta_{M\&A2}M\&A_{(i,t)} + \beta_{NP2}NP_{(i,t)} + \alpha_{ER2}ER_{(i,t)} + \varepsilon_6 \quad (9)$$

Where $Y_{3,t=}$ = ENVR, which stands for the manufacturing industry's environmental performance across the sample period.

Specifically, $Y_{3,t=}$ = ENP represents the manufacturing industry's environmental policy throughout the sample period. Overall environmental cost of the manufacturing industry throughout the sample period is shown by the formula $Y_{4,t=}$= TEC. The green innovations of the manufacturing industry across the study period are shown by the formula $Y_{5,t=}$ = GINN. The environmental performance that mediator ENP has affected across the sample time is represented by $Y_{3,t}$. The environmental cost impacted by mediator ENP throughout the study period is represented by $Y_{5,t}$. The green innovations affected by mediator ENP across the study period are represented by $Y_{5,t}$.

For regressions with two dependent variables, we use the Probit model. Environmental policy is the mediating variable in the regression, and it has a value of 1 if the firm has an independent environmental policy in the relevant year and 0 otherwise.

4. Results and Discussion:

In this part, we go into our panel data to examine how mergers and acquisitions affect environmental sustainability when mediated by environmental policy. The findings of the Probit model are shown in Table 3.

Table 3: Probit results

Variables	Model ENVR
ER	-0.0608***
	(0.0198)
NP	− 2.0212*
	(0.7786)
M&A	0.1869***
	(0.0528)
Constant	− 0.467***
	(0.0734)
Observations	5,023

Robust standard errors are reported in parentheses, ***, ** and * indicating significance at 1%, 5% and 10% level respectively.
Source: Authors' own calculations

Table 3 shows that mergers and acquisitions significantly affect independent environmental policy in manufacturing sector. Clearly, businesses involved in M&A may be more eager to dedicate themselves to sustainable initiatives, such environmental protection, hence enhancing environmental performance. A business may notify the public that it has grown to be a larger and more effective corporation following a merger or acquisition. Because of this, the company could be more inclined to engage in environmental responsibility initiatives, one of which might be enhancing environmental performance. To that end, Hypothesis 3, which contends that M&A may enable businesses to take on more environmental responsibility, can be accepted.

This outcome is mostly due to China's manufacturing sector's increased modernization and transformation over the past several years, as well as a progressive decline in the industry's environmental pollution effect, making M&A significant in terms of enhancing environmental performance. The occurrence of M&A frequently helps firms better integrate their resources, increase the efficiency of resource usage, and thereby enhance their environmental performance. As a result, M&A significantly affects how environmentally responsible an industry.

So, we can confirm that Hypothesis 3 is accurate, but Hypothesis 1 may be reliable in characterizing the relationship between M&A and environmental performance within the manufacturing business.

We stress the fact that M&A improves the environmental performance of highly polluting companies.

Table 4: Pooled results

Variables	Model 1 TEC	Model GINN
NP	− 0.00243	0.00356
	(0.00534)	(0.00298)
ER	6.2366	5.8908*
	(2.7906)	(3.7808)
M&A	-5.7658**	4.7806***
	(2.5098)	(2.0506)
Constant	-0.9987*	7.9236***
	(0.5767)	(2.1236)
Observations	5012	10,812
R-squared	0.028	0.032

Robust standard errors are reported in parentheses, ***, ** and * indicating significance at 1%, 5% and 10% level respectively.

Source: Authors' own calculations

Tables 4 present the findings of these two models. The effects of the control variables & M&A on the cost to the environment and green innovations in the manufacturing sector are shown in this table. We can observe from results that M&A has a significant effect on lowering environmental costs. The coefficient is -5.7658, which indicates a negative significant value of M&A has a beneficial effect on lowering environmental costs in the industrial sector. Further the results show that M&A has positive impact on green innovations in manufacturing sector of China. This outcome validates Hypothesis 2. Therefore, we may argue that M&A has a favorable effect on sustainable environment.

4.1. Robustness check

Both the Gauss Markov model and the Logit regression model are presented in this section for the robust checks of our findings with relation to Hypotheses 1-3. We use the Gauss Markov Theorem based on the Gaussian Markov Model to make sure that our findings are BLUE. According to [39], optimal linear estimation and generic Gauss-Markov theorems in linear models are with flexible nonnegative covariance structure. The fundamental assumptions have been verified. Our regression models' error terms have the following characteristics:

1. They all have a mean of zero;
2. They are all uncorrelated with the main explanatory factor.
3. They all have equal variances with no effect from heteroskedasticity.

The findings are presented in Table 5 where it's evident that all error variance for our models get a mean that is near to zero, allowing us to verify the hypotheses.

Table 5: Mean of error term

Model	Mean of Error Term
NP	− 4.0129
ER	4.9210
NI	− 0.0039
ENP	0.0032
TEC	-0.0043
GINN	0.0009

Source: Authors' own calculations

Therefore, hypothesis 1 has been confirmed. Next, we used the Pearson correlation coefficient test to see if the error term and our main explanatory variable, the M&A variable, were correlated. The findings are shown in Table 6 in which all correlation coefficients are negligible, proving hypothesis 2.

Table 6: Pearson correlation between explanatory variables with error term

Model	Pearson Correlation
NP	− 0.02
	(0.1)
ER	− 0.02
	(0.1)
NI	0.01
	(0.99)
ENP	− 0.02
	(0.1)
TEC	0.02
	(0.1)
GINN	0.1
	(0.98)

Source: Authors' own calculations

Lastly, we use the White test to evaluate the heteroskedasticity effect. Table 7 shows the findings; all Chi-2 stats are not significant, except for the TEC model. As a result, the manufacturing industry's TEC model has not been necessary to verify assumption 3. We thus go on to alter the TEC model, which reveals heteroskedasticity, using the Newey-West robust regression approach.

Table 7: White test result

Model	White test results
NP	6.02
	(0.92)
ER	15.31
	(0.71)
NI	8.92
	(0.1)
ENP	20.01
	(0.50)
TEC	0.78
	(0.34)
GINN	6.41
	(0.63)

Source: Authors' own calculations

Table 7 displays the findings, which are nearly comparable to those in Table 4 in terms of content. It may be argued because our model estimations are BLUE hence our findings are solid as a result. Also, we employ the logit model as a substitute for the probit linear regression in the manufacturing sector.

Table 8: Logit results

Variables	Model 2 ENVP
NP	-0.05243***
	(0.0031)
ER	− 1.1209
	(1.8509)
M&A	0.40213***
	(0.06690)
Constant	− 0.79451***
	(0.12678)
Observations	4902

Robust standard errors are reported in parentheses, ***, ** and * indicating significance at 1%, 5% and 10% level respectively.

Source: Authors' own calculations

The Logit model's findings are presented in Table 8. When compared to the outcomes of our Probit model on Tables 3, both models' outcomes are quite comparable. The endogeneity problem, often known as the "fixed effect" in panel data analysis, occurs when explanatory variable is associated with the error term. As the explanatory variable and the error term are connected in this instance, endogeneity becomes an issue. Instead of the fixed effect model, we use the pooled data model in

our model. More significantly, we have shown that all our models' error terms do not correlate with our main explanatory variable (see Table 6). Thus, the endogeneity issue might not apply to our model. So, it is reasonable to assume that our findings are valid.

Table 9: Mediating effect of environmental policy

Variables	Model 1 EP	Model 2 CSR	Model 3 EC
ENP	0.00506*	0.0834***	2.9806***
	(0.00301)	(0.0021)	(0.9877)
Constant	0.392***	0.765***	1.7677**
	(0.0323)	(0.0199)	(0.3348)
Observations	1786	1786	998
R-squared	0.003	0.001	0.008

Robust standard errors are reported in parentheses, ***, ** and * indicating significance at 1%, 5% and 10% level respectively.

Source: Authors' own calculations

According to Table 9, environmental policy (ENVP) in the manufacturing sector is statistically significant in Models 1 to 3. These findings imply that the mediating variable has positive impact on environmental responsibility, energy consumption and green innovations suggesting a positive role in environmental performance. Furthermore, it is evident from Table 10 that ENP, the mediating variable, is significantly associated with M&A, EVAR, TEC and GINN. In conclusion, if a company's environmental policy is significantly improved following an M&A, we may claim that the company may improve environmental sustainability through environmental responsibility, total energy consumption and green innovations.

Table 10: Regression results

variables	Model-1 ENP	Model-2 ENP
M&A	0.2501***	
	(0.078)	
ER	− 0.0345	− 0.0676
	(0.0612)	(0.0798)
NP	− 2.1911	− 5.9810
	(1.671)	(4.7610)
EVAR	0.5982*	− 0.254
	(0.387)	(1.078)
TEC	0.0627***	0.0589**
	(0.0209)	(0.0198)
GINN		0.0678***
		(0.0093)

Robust standard errors are reported in parentheses, ***, ** and * indicating significance at 1%, 5% and 10%.

Source: Authors' own calculations

The fact that this result is identical to the earlier ones leads us to think that the mediating variable i.e. environmental policy is significant in this relationship. All four outcomes are positive in the findings, and it can be argued that environmental policy is crucial to the sustainability of the environment. Our findings therefore add to the agency theory, which places a strong emphasis on the alignment of economic interests through environmental policy. We also show that environmental policy may effectively promote environmental goals like environmental sustainability and environmental protection.

5. Conclusion with policy Recommendations

This study examines the impact of mergers and acquisitions (M&A) on the sustainability of the environment for highly polluting businesses, primarily manufacturing sector. Our research shows that M&A benefits environmental performance of manufacturing sector. We also demonstrate how M&A across businesses may strengthen environmental responsibility of the firms. The impact of mergers and acquisitions on environmental responsibility is shown to be positively significant. Lastly, we found that M&A reduces environmental costs. By examining the effect of M&A on green innovations, we further investigate this problem and show that M&A have a favorable effect on green innovations, which may have a partial impact on environmental cost.

After that, we examine the mechanism by which M&A impacts environmental sustainability, making the case that the favorable effects might be due to improved environmental policy. Thus, we investigate whether environmental policy has a mediating effect. The environmental policy has a mediating impact on firms' environmental responsibility in the manufacturing sector. Environmental policy is essential for improving how environmentally sustainable Chinese manufacturing businesses are. It is conceivable that M&A leads to environmental reorganizations and afterwards optimize business's environmental structure. This improves environmental responsibility among the firms, which can lead to management improvements in a variety of areas, including sustainable environmental development. These findings provide the astounding insight that improved or effective environmental policies may be needed for Chinese manufacturing corporations to improve their environmental performance. Therefore, we contend that improving environmental sustainability is important for both human existence and the protection of the environment. It's because all the tested companies are publicly traded businesses with

enormous net profits and rapid capacity development. As a result, such firms want to establish their reputation by fulfilling more societal obligations, including safeguarding the environment.

Our work also has significant policy implications since it shows how M&A can enhance environmental sustainability in several ways. Via the environmental channel, M&A transactions in sector have a more significant and favorable influence on environmental sustainability. So, through M&A-induced environmental reorganizations, the government may encourage environmental policy improvements in manufacturing sector, which may result in sustainable environmental development. We advise manufacturing firms to place more emphasis on research and development since these industries may benefit from stronger environmental sustainability thanks to modern technologies. The government, while on the other hand, can offer greener financing and credits to businesses who invest in enhancing environmental sustainability which can help to achieve SDGs within the country.

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