IMPACT OF ECO-INNOVATION ON ENVIRONMENT PERFORMANCE AND COMPETITIVE ADVANTAGE: MODERATING EFFECT OF GREEN REPUTATION

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Abstract- Climate change has become one of the most concerning issues of the 21st century worldwide, as the world is presently suffering from global warming and unrecoverable damage. In particular, after the 2015 United Nations Climate Change Conference (COP21), governments, investors, and consumers have become sensitive to issues such as environmental protection and management, effects of climatic change and solutions, and economic operation infrastructure. Based on the institutional theory, the natural resource based view, and legitimacy theory, this study examines the linkages among institutional pressures, environmental innovation practices, and competitive advantages. Specifically, the moderating effect of green reputation on the consequences of environmental innovation and environment performance practices are examined. Data on135 manufacturers, collected from Taiwan and China, are used to test the theoretical model. The results reveal that institutional pressures arising from customer and shareholder pressure exert a significant positive impact on environmental innovation practices, while the government's command-and-control instruments and economic incentive instruments do not have an impact. Additionally, the environmental innovation practices have a significant positive impact on firms' environmental performance and competitive advantages. Analysis also reveals that the relationship between environmental innovation practices and competitive advantages is moderated by the level of green reputation. As green reputation increases, the competitive advantages yielded from environmental innovation practices, as well as from environment performance practices, also improve.

Keywords- Environmental innovation practices, Institutional theory, Green reputation, Environment performance, Competitive advantage.

I. INTRODUCTION

Climate change has become an important worldwide issue in the 21st century, following the promotion of economic development. After the industrial revolution,the rapidly growing population consumed significant energy and natural resources, especially fossil fuels.Forest destructionor greenhouse gas pollution resulted in the current global warming and it has ledtoirreversible ecological and environmental harm [1].

These gases or pollution produced in the early years did not draw attention. At the time, these "social external costs" (known as external diseconomies) were not taken into consideration by the manufacturer or the consumer, which exacerbated climate change and environmental damage [2].

In response to this trend, numerous countries and economies have begun to focus on issues such as environmental protection and management, the effects of climatic change and solutions, and economic operation infrastructure. Therefore, governments, investors, and consumers also focus on asignificant issue: is a more selfish approach worthwhile to improve their own interests while ignoring the environmental impact, or is it more important to pay additional costs for processing but lose competitiveadvantage?
Taiwanese firms are an important partin the global supply chain, comprising most manufacturers of production patterns, mostly original equipment manufacturers or own designing andmanufacturing, which commission the design and manufacture or original design manufacturing [3].Therefore, Taiwanese firms rely heavily on foreign markets.

After the 2015 United Nations Climate Change Conference (COP21), 195 countries unanimously adopted the Paris agreement to replace the expiring Kyoto Protocol, which is expected to come into effect in 2020. Participating countries shall propose nationally determined contributions,and, beginning in 2023, they need toreview and amend their carbon emissions progress every five years. Participants try to appeal about climate change issues for companies to sign 7 initiatives, and a total of 247 companies have responded,7of which are from Taiwan [4].

For Taiwan's enterprises, regardless whether the motivation is active or passive, to meet customer demand and have a supply system of green, ecological innovation (eco-innovation) has become a necessary strategy [5]. Additionally,innovation impactsthe enterprise's environment performance and competitive advantage[6].

However, the findings regarding the relationship betweenenvironment performance and competitive advantage are mixed [6-10]. Traditional economic views show that most environmental improvement effortsgenerateunnecessary costs to the firm from the society. As such, there is a trade-off between

environmental responsibility and competitive advantage. Certain studies also suggest that environmental managementpractices will actually lead to lower operations costs, lower waste, and higher profit margins [11, 12]. Consequently, this study analyzes the relationship between environmental practices and competitive advantage.

Based on the perspective of institutional theory, natural resource-based view, and legitimacy theory, this study extends the discussion of antecedents and consequences on environmental innovation practices.A framework with three dimensions of institutional pressure (coercive, normative, and mimetic pressure), introduced by DiMaggio and Powell's [13]is employed in this study,along with corporate social responsibility (CSR),to examine influences on environmental innovation practices and performance.

Moreover, this study responds to the debate on the relationship between environmental innovation practices and environment performance, environmental innovation practices and competitive advantage, environment performance and competitive advantage.

Green reputation is introduced as a moderator,based on the natural resource-based view and legitimacy theory, to test whether it has a moderating the effect on the relationship between the others constructs. Specifically, I address the following research questions:

1. Examining companies' motivations on eco-innovation practices.
2. Studying the relationship between eco-innovation practices and environment performance.
3. Analyzing the relationship between eco-innovation practices and competitive advantage.
4. Determining the relationship between environment performance and competitive advantage.
5. Assessing the relationship between environment performance and competitive advantage, with a moderating effect from green reputation.

II. METHODOLOGY

2.1. Hypothesis development

2.1.1. Institutional pressure

Numerous researchers recognize the importance of institutional theory in explaining firm behavior [13-16]. In this study, I integrate three "isomorphic pressures," the coercive, normative, and mimetic pressure. Each of them suggests a testable hypothesis to examine the drivers of environmental innovation practices.

Government environmental regulations are an important coercive pressure to firms' environmental initiatives [17, 18]. While Porter and Van der Linde [6] and Murphy and Gouldson [19] propose that if an action has a rewarding effect, companies tend to have a higher willingness to perform environmental innovation. However, certainresearchers believe that government regulations for business willingness do not have a significant impact [15, 20]. However, research proposed that government regulations control the operation of enterprises to innovate willingness to have a negative impact on the effect [9].

Another stream of research focuses on the influences of different government policies: command-and-control versus economic incentive instruments. Regulatory pressures can have a pull or push effect on eco-innovations among organizations, and can be classified as "carrots" (benefits) and "sticks" (punishments) [21, 22].

Market-based measures belong to the "carrots" and command-and-control ones belong to the "sticks"[23]. Therefore, we propose that:

H1. Government command-and-control and market-based environmental regulationsare positively associated with a company's eco-innovation practices.

Market requirement and expectations are expressed as normative and mimetic pressures. Normative pressures may derive from the community, including markets, media, and the general public demand, and mimetic pressures can be attributed to competitive norms and rules [24].

Berthon et al. [25] find that market demand plays a critical role in a company's innovation performance. Additionally,in recent times, some companies have commenced using environmental innovation to enhance their efficiency, product quality, or green image in competitive markets to satisfy customer requirements and expectations [17, 26]. Therefore, we propose that:

H2. Customer requirements and expectations are positively associated with a company's eco-innovation practices.

2.1.2. Corporate social responsibility

In recent decades, companies are interested in CSR and its related business performances. Different stakeholders try to raise pressures (e.g., public concern, regulatory forces, consumer pressure, industry peer pressures, reputation concerns, media interest, and perceived market advantage)[27]for companies to improve their CSR performances and release the related reports.

When respondingregardingCSR requirements, companies were asked to provide the "ESG (environmental, social, and governance) report." ESG refers to the three main areas of concern that have developed as central factors in measuring the sustainability and ethical impact of an investment in a company or business.

Moreover, socially responsible investment (SRI) can be broadly defined as an investment process that involves identifying companies with high CSR profiles, evaluated on the basis of ESG criteria [28], which combine the two to trigger the firm's environmental innovation practices.

Hence, we postulate the following hypothesis.

H3. CSR and SRI are positively associated with a company's eco-innovation practices.

2.1.3. Environmental innovation practices and performance

Eco-innovation is a common environmental strategy that many firms adopt to achieve superior environmental and economic performance simultaneously [29].

Eco-innovation can be further defined in terms including organizational management [9], production process [30], and new product development [31]. Environmental innovatory performance includes efficient use of resources, reduction of wastes and energy consumption, and reduction of environmental risks [32]. As such, eco-innovation can help identify production inefficiencies and existing environmental technologies, improve energy efficiency, and, at the same time, lead to product innovations [6, 8, 33]. Therefore, we propose that:

H4. Eco-innovation practices are positively associated with acompany's environment performance.

However, a company's innovative activity may provide a competitive advantage [34]. Ecological modernization theory shows that the environment innovation strategy can achieve environmental and finance performance [19, 35]. This leads to the development of the following hypothesis:

H5. Eco-innovation practices are positively associated with a company's competitive advantage.

Additionally, thenatural resource-based view (NRBV) provides a theoretical basis for discussing the contribution of resources and capabilities to the performance of eco-innovation [36-38]. Based on NRBV, the investment in eco-technology may foster the development of a company's resources and capabilities, which form the basis for its competitive advantage [39, 40].

Sharma and Vredenburg [41] point that the activities in proactive environmental practices (i.e., pollution prevention) can actually contribute to the development of valuable capabilities, such as environmental responsiveness, organizational innovation, and stakeholder integration.

As a result, companies that develop these capabilities related to environmental management are able to achieve a greater financial performance. Companies' commitment to the environment has become one significant competitive factor [42],which leads to the following hypotheses:

H6. The company's environment performance is positively associated with its competitive advantage.

2.1.4. Green reputation

Research on corporate social performance (CSP) and corporate reputation (CR) has developed along parallel theoretical lines, with both concepts broadening theoretically to include all stakeholder relations. Legitimation transforms CSP, an objective flow variable, into CR, a perceptual stock variable [43].

Legitimacy is "a value whereby something or someone is recognized and accepted as right and proper" [44],and impacts reputation [45]. As such, a firm with good environmental initiatives may enhance its environmental reputation [46].

Research on the relationship between reputation and firm performance shows that not only financial benefits, but also non-financial advantages, are outcomes of a good reputation [47-51]. Therefore, I propose that:

H7. The greener the reputation accumulated, the stronger the positive relationship between eco-innovationandcompetitive advantage.

H8. The greenerthe reputation accumulated, the stronger the positive relationship between environment performance and competitive advantage.

Figure 1shows the conceptual framework of this study.

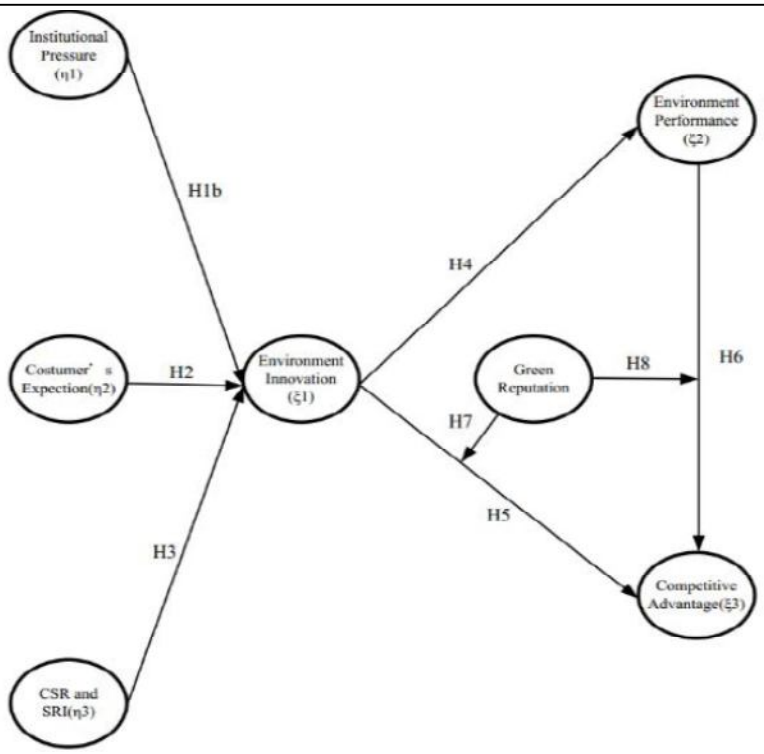

Figure 1. The conceptual model for the relationships among institutional pressures, environmental innovation practices, green reputation and performance.

2.2. Research methodology

2.2.1. Data collection

Data were collected from manufacturing firms in Taiwan and China, by e-mail and electronic questionnaires. We have received 172 responses, 37 of which were incomplete. A total of 135 questionnaires were valid, representing an effective response rate of 78.50%. Descriptive statistics for the respondents are given in Table 1.

Table1: Descriptive statistics for the respondents Company profiles (N=135).

Information	Characteristics	Samples	Percent
Founded time	Less than 1 year	3	2.2%
	1-5 years	15	11.1%
	6-10 years	14	10.4%
	11-25 years	64	47.4%
	More than 25 years	39	28.9%
Fixed Assets (NTD)(10 Thousand)	Less than 5000	10	7.4%
	5000-9999	10	7.4%
	10000-14999	18	13.3%
	15000-19999	11	8.1%
	20000-25000	9	6.7%
	More than 25000	77	57%
Employee	1-100	26	19.3%
	101-500	55	40.7%
	501-1000	24	17.8%
	1001-2500	11	8.1%
	More than 2500	19	14.1%
Industry	Food, Beverage, Alcohol and cigars	2	1.5%
	Electronics and Appliances	50	37%
	Non-ferrous metal	3	2.2%
	Fabricated metal product and Machinery	4	3%
	Rubber & Plastics	2	1.5%
	Chemicals and Petrochemicals	37	27.4%
	Transportation equipments	10	7.4%
	Electrical machinery Industry	2	1.5%
	Publishing and printing	3	2.2%
	Others	22	16.3%
Years of Experience	Less than 5 years	45	33.3%
	5-10 years	29	21.5%
	11-15 years	32	23.7%
	16-20 years	14	10.4%
	More than 20 years	15	11.1%

2.2.2. Psychometric properties

The measurement items and the values of Cronbach's alpha are reported in Table 2. The content validity for the survey instrument is supported by literature, and the confirmation factor analysis model is estimated to assess the construct validity using SPSS 22.0 and AMOS 19.0.

Table2: Measurement items and Cronbach's alpha for latent variables.

Measurement items	Cronbach's α
Regulationinstrument (RI)	**0.881**
RI1: The government provides preferential subsidy on environmental innovation	
RI2: The government provides preferential tax policy on environmental innovation	
RI3: The government's propagations on environmental protection	
Customers' requirement andexpectations(CRE)	**0.851**
CRE1: The overseas customers require our products meet the requirements of environmental regulations	
CRE2: The overseas customers pay great attention to the green concept contained in products	
CRE3: The domestic customers require our products meet the requirements of environmental regulations	
CRE4: The domestic customers pay great attention to the green concept contained in products	
Corporatesocial responsibility(CSR)	**0.854**
CSR1: The company display its responsibility towards a wide range of stakeholders	
CSR2: The company respond to stakeholders' expectations and contribute to society well-being	
CSR3: The company manage their own legitimacy	
CSR4: The company try to reduce information asymmetries and improving stakeholder decision making	
Environmental innovation practices (EI)	**0.919**
EI1: The company often innovatively updates manufacturing processes to meet standards of environmental law.	
EI2:The company often places emphasis on developing new eco-products through new technologies to reduce damage from waste as much as possible.	
EI3: The company often places emphasis on developing new eco-products through new technologies to easily recycle their components	
EI4: The company often places emphasis on developing new eco-products through new technologies to use natural materials	
GreenReputation(GR)	**0.938**
GR1: The company can establish the advertising and marketing benefit through green reputation	
GR2: The company can improve the bargain capability through green reputation	
GR3: The company can attract more talented person through green reputation	
GR4: The company can attract more investors through green reputation	
GR5: The company can increase its market share through green reputation	
GR6: The company can increase their barriers to competition through green reputation	
Environmentalperformance(EP)	**0.870**
EP1:Wecan reduce the air emission, waste water, solid wastes	
EP2: We can reduce the frequency for environment accidents	
Ep3: We can improve the environmental image	
Competitive Advantage (CA)	**0.934**
CA1: We can reduce the hazardous waste, emissions, etc.	
CA2: We can consume less resources, such as energy, water, electricity, gas and petrol	
CA3: We can satisfy our customer by produce a new design and development	
CA4: We can produce something product with innovation design and skill	
CA5: We can provide high quality of product and service	

In this model, each item is linked to its corresponding construct with freely estimated covariance. The model fit indices are X2 /df=1.156, CFI=0.903, IFI=0.991, TLI=0.937, and RMSEA=0.034, which shows that the measurement model is acceptable [52]. All factor loadingsare greater than 0.5, their p-values are significant at the 0.01 level (Table 3), and their divergent validity is ensured [53].

Moreover, the composite reliability of all constructs is greater than 0.7, making them acceptable [54].

Table3: Measurement model of latent variables.

Completely standardized loading (standard error)	P	Composite reliability	AVE
Regulation instrument (RI) 0.880		0.872	
RI1 0.898(----)			
RI2 0.892(0.151)	***		
RI3 0.768(0.157)	***		
Customers' requirement 0.855		0.810	
and expectations(CRE)			
CRE1 0.784(----)			
CRE2 0.698(0.239)	***		
CRE3 0.800(0.361)	***		
CRE4 0.776(0.276)	***		
Corporate social 0.854		0.831	
responsibility(CSR)			
CSR1 0.733(----)			
CSR2 0.834(0.082)	***		
CSR3 0.706(0.095)	***		
CSR4 0.671(0.114)	***		
Environmental innovation			0.919
0.909			
practices (EI)			
EI1 0.673(----)			
EI2 0.675(0.087)	***		
EI3 0.735(0.090)	***		
EI4 0.718(0.096)	***		
Green Reputation (GR)			0.938
0.873			
GR1 0.837(----)			
GR2 0.861(0.069)	***		
GR3 0.838(0.079)	***		
GR4 0.893(0.070)	***		
GR5 0.924(0.081)	***		
GR6 0.887(0.077)	***		
Environmental performance (EP)			0.870
0.893			
EP1 0.796(----)			
EP2 0.675(0.074)	***		
EP3 0.751(0.093)	***		
Competitive Advantage (CA) 0.934		0.888	
CA1 0.844(----)			
CA2 0.846(0.069)	***		
CA3 0.786(0.083)	***		
CA4 0.834(0.073)	***		
CA5 0.742(0.088)	***		

Additionally, the square root of the average variance extracted for each construct is greater than 0.5,and the correlations between constructs arepresented in Table 4.

Table4: Results of Correlations between latent variables

Construct	Correlations						
	RI	CRE	CSR	EI	GR	EP	CA
RI	1						
CRE	0.441**	1					
CSR	0.374**	0.446**	1				
EI	0.470**	0.523**	0.654**	1			
GR	0.404**	0.398**	0.584**	0.496**	1		
EP	0.417**	0.426**	0.584**	0.683**	0.620**	1	

Lastly, the model is acceptable. The structural equation model and the t-test of each path are shown in Figure 2, and their significance level is 95%. The statistical results lend support for H2–6, while H1 is not supported.

In addition, we used hierarchical regression to examine the moderating effect of green reputation on the relationship between environmental innovation practices and competitive advantage.As such, H7 and H8 are supported.

III. RESULTS AND DISCUSSION

3.1. Institutional pressures and environmental innovation practices

From the results, institutional pressure for manufacturers of ecological innovation is not significant. In recent years, the global environment-related issues caused by globalization and the popularity of many countries have begun to be significant and determine how to proceed with reforms and maintenance.

Comparably, the country or regional government agencies began to establish standards and regulations related to environmental management in order to promote eco-innovation and encourage enterprises to save energy. These regulations and standards include raw materials, product design, production process, and subsequent processing of waste or pollution. If the enterprise related reforms do not comply with regulatory requirements, it will be subject to certain penalties, and, the most serious, it must leave the market. Similarly, the government will provide subsidies or tax concessions to enterprises, reducing the cost of eco-innovation.

Eiadat et al. [9] and Zhao and Sun [55] believe that the government should be adapted to local conditions when legislating. It also has to gauge the relationship between environment and corporate profits, and to seek economic development.

Related assistance and subsidies when companies must measure eco-innovation are provided to enhance enterprise innovation performance.Additionally,the cooperation between local government and the region's enterprises requires restructuring. As such, the government must ensure that its policy is to focus on environmental innovation, rather than only on the product or compliance with environmental standards and regulations.

Similarly, consumers' purchase intention and investors' willingness to invest will affect the willingness to practice ecological innovations. Recently, international enterprises have gradually moved toward the green supply chain development. Taiwanese firms, an important part of the global supply chain, also have to pay attention to this issue. Especially in recent years, Taiwan joined the WTO on trade policies and had signed numerous FTAs with other countries or economies. As such, Taiwan’s enterprises have to comply with local governments, consumers’ demand for products, and environmental protection.

Likewise, in order to obtain the favor of international investors, Taiwanese companies need to actively participate in CSR and SRI related specifications and protocols to attract the Asian Association for Sustainable and Responsible Investment and other relevant organizations or investors.

3.2. Environmental innovation practices and performance

Enterprise eco-innovation will have a positive impact on its environmental performance and competitive advantage effect. Enterprises can significantly reduce or avoid ecological damage not only via green procurement, green manufacturing, green marketing, green consumption, green recycle,and green logistics[56],but also byincreasing the competitors’ market share and marketing advantages. Subsequently, they need cover the cost of eco-innovation.

Successively, if companies decide to improve their green reputation in the market, the positive relationship between eco-innovation, environmental performance innovation, and competitive advantage will be more significant.

It also means that when enterprises want to assess their own value, in addition to the traditional tangible assets, such as intellectual property or intangible assets, reputation can also be emphasized [57].

CONCLUSIONS

This study provides interesting implications for both practitioners and policy-makers in the context of the climate change adaptation.

First, except for the government's regulation instrument, customers' requirements and expectations and CSR activity exert a significant positive impact on environmental innovation practices.

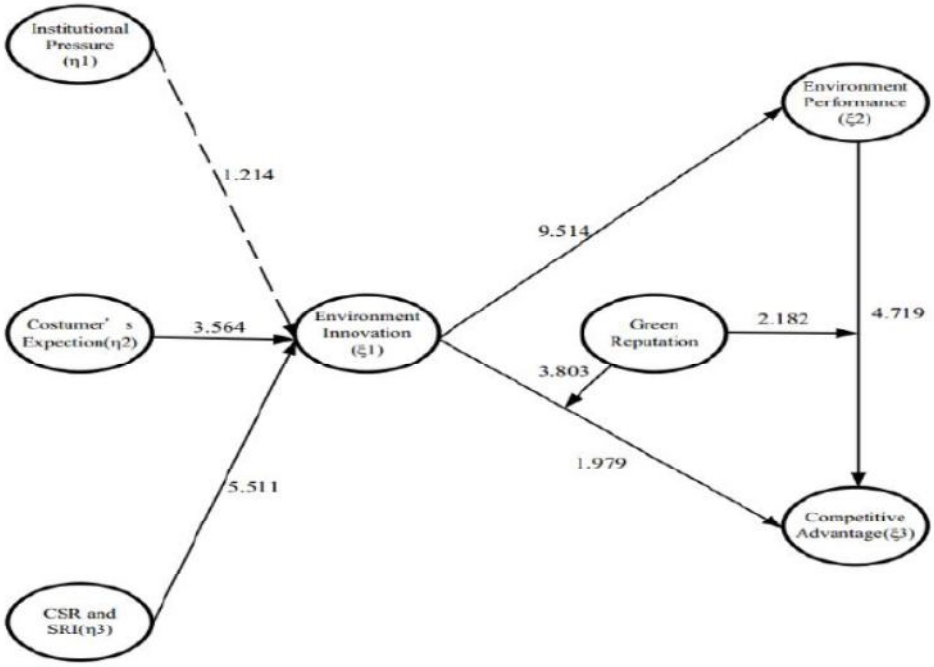

Figure 2. The structural equation model result for the conceptual mode

Second, we recognize that any effort on environmental improvement, such as an economic and competitive opportunity, is not an additional operational cost. Finally, the results of this paper show that green reputation has become one of the most important drivers of competitive advantage.

One of the limitations of this study is that I collected data solely from Taipei, Taichung, and Kaohsiung, Taiwan. Therefore, the results are context specific and may not be applicable in a wider context.

Another limitation is that the data are cross-sectional. A longitudinal study would allow inferring the causative implication as to the effect of institutional elements on eco-innovation practices, environment performance, and competitive advantage improvement.

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