Advances in Management & Applied Economics, vol.2, no.4, 2012, 223-241
ISSN: 1792-7544 (print version), 1792-7552 (online)
Scienpress Ltd, 2012

An Empirical Study on Taiwanese Logistics Companies' Attitudes toward Environmental Management Practices

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Abstract

Drawing on theories about technical innovation, this paper aims to analyze the factors influencing Taiwanese logistics companies' attitudes toward environmental management practices. The determinant factors include technological, organizational and environmental dimensions. Data to test research hypotheses came from a questionnaire survey on logistics companies in Taiwan. Research findings reveal that complexity, compatibility and relative advantage of environmental management practices, quality of human resources, organizational support, governmental supports and regulatory pressure have significantly positive influences on Taiwanese logistics companies' attitudes toward environmental management practices. However, the influences of environmental uncertainty and customer pressure are not significant for Taiwanese logistics companies. Based on the research results, the paper discusses implications and opportunities for future research.

Keywords: environmental management practices, determinants of innovation, technical innovation, logistics companies, Taiwan

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Article Info: *Received* : August 26, 2012. *Revised* : September 21, 2012
Published online : November 15, 2012

1 Introduction

To pursue sustainable development, environmental issues have become critical concerns all over the world. An increasing number of companies are constantly under pressure to develop environmentally responsible and friendly operations, and regard commitment to the natural environment as an important variable within the current competitive scenarios. They are attentive to the concept of enhancing their competitiveness through improvements in the environmental performance, addressing the environmental concerns of their customers, and mitigating the environmental impact of their production and service activities. Many researchers have proposed various explanations as to what factors influence firms' adoption of environmental management practices. Stakeholder pressure, environmental regulation, company size, managers' characteristics, human resources and industry sector are relevant variables frequently appeared in related research (Etzion, 2007; Gonzalez-Benito & Gonzalez-Benito, 2006).

Most studies on environmental issues focus on the manufacturing sectors that may consume considerable natural resources and generate substantial contaminants, such as the energy, chemical, automotive, forestry/pulp/paper, and electronic industries. Little research pays attention to the environmental issues in service sectors because most service sectors may consume less natural resources and have smaller impact on the environment than the manufacturing sectors (Ramus & Montiel, 2005). Nevertheless, logistics operations often lead to negative impact on the natural environment, including air pollutants, hazardous and solid waste disposal, and fuel consumption (Rondinelli & Berry, 2000). The logistics industry consumes more natural resources and generates more contaminants than other service sectors, and thus needs to address more efforts on environmental management. Logistics companies carry out logistics activities for their customers, including warehousing, transportation, inventory management, order processing, and packaging (Delfmann, Albers, & Gehring, 2002). Logistics is a link in providing green products from the manufacturers to the consumers. Green products will be truly green if the value adding logistics activities also become green (Wu & Dunn, 1995). Environmental issues in the logistics industry are crucial for studying. However, only a limited number of articles analyze environmental issues in the logistics industry (Lin, 2011). Much remains to learn empirically about the factors influencing logistics companies' attitude toward environmental management practices.

Applying environmental criteria into corporate operations requires exploring new resource combinations and deploying existing resources in new ways (Hart, 1995). Adopting environmental practices involves implementing new or modified processes, techniques and systems to reduce environmental harms. As innovation is the use of new technical and administrative knowledge, the adoption of green practices can be regarded as an innovation process. Several researchers (e.g., Henriques & Sadorsky, 2007; Rothenberg & Zyglidopoulos, 2007) analyze environmental issues from the perspective of innovation. Most of them provide an

insight into the influences of certain organizational and environmental factors on green innovation. However, little empirical research analyzes how technological, organizational and environmental factors simultaneously influence the adoption of environmental management practices. Organizational and external environmental factors are two factors commonly considered in the studies of green innovation (Etzion, 2007; Gonzalez-Benito & Gonzalez-Benito, 2006).

Scarce attention has been paid to the influences of technological characteristics on green innovation (Lin & Ho, 2011). The nature of technology, the capabilities of the organization, and the external environment are three general characteristics affecting the adoption of new technologies (Chau & Tam, 1997; Frambach & Schillewaert, 2002; Tornatzky & Fleischer, 1990). Characteristics of a new technology such as compatibility, complexity, and relative advantage may affect its adoption (Jeyaraj, Rottman, & Lacity, 2006; Rogers, 2003; Tornatzky & Klein, 1982). Frambach and Schillewaert (2002) place the perceived characteristics of the innovation at the heart of their organizational innovation adoption model. Technological characteristics should be taken into account when analyzing environmental issues. Therefore, based on our previous study (Lin & Ho, 2011), this paper analyzes the influences of technological, organizational, and environmental factors on Taiwanese logistics companies' attitudes toward environmental management practices.

The next section illustrates the theoretical backgrounds and formulates research hypotheses about the factors influencing the adoption of environmental practices. The third section gives a description of the research methodology, while the fourth section focuses on the analysis of the results and the discussion of the findings. The final section gives research conclusions.

2 Research Hypotheses

Innovation consists of any practice that is new to organizations, including equipments, products, processes, policies and projects. Technical innovation pertains to products, services, and production technologies; it is related to basic activities and concerned with either product or process (Damanpour, 1991). Adopting environmental management practices is a technical innovation process. The literature includes a number of explanations as to what factors influence technical innovation. In general, technological, organizational and external environmental contexts affect the adoption of environmental innovations (Lin & Ho, 2011). Some researchers (Lin & Ho, 2011) have found that technological, organizational and environmental factors significantly influenced the adoption of green practices for logistics companies in China. Using the same research framework (Lin & Ho, 2011), this paper will analyze the influences of technological, organizational, and environmental factors on Taiwanese logistics companies' attitudes toward environmental management practices.

2.1 Technological Factors

The perceived technological factors of an innovation are cognitive beliefs reflecting an attitude towards the innovation. Several technological factors of an innovation can affect its adoption, including complexity, compatibility, relative advantage, triability, ease of use, perceived usefulness, information intensity, uncertainty, and so on (Frambach & Schillewaert, 2002; Jeyaraj et al., 2006; Tornatzky & Klein, 1982). This study focuses mainly on complexity, compatibility and relative advantage because these three characteristics are important in influencing technical innovation adoption behavior (Lin & Ho, 2011; Rogers, 2003; Tornatzky & Klein, 1982).

Complexity is the degree to which a technical innovation is relatively difficult to understand and use. Complexity increases the difficulty in knowledge transfer and innovation diffusion (Rogers, 2003), and scholars usually hypothesize that complexity relates negatively to innovation adoption (Tornatzky & Klein, 1982). Environmental practices incorporate both tacit and explicit knowledge. The tacit knowledge may be inherent in identifying sources of pollution, reacting quickly to accidental spills, and proposing preventive solutions (Boiral, 2002), and leads to the ambiguity of the practices. Ambiguity is a major barrier to the transfer of best practice within a firm (Szulanski, 1996). A technology will be more complex while it reveals a higher level of ambiguity. Efficient knowledge sharing can lead to better innovative capabilities in terms of higher order learning, and consequently can improve organizational performance including environmental management effectiveness (Etzion, 2007). A technology with high complexity contains a lot of tacit knowledge that requires laborious efforts to learn and diffuse (Tornatzky & Fleischer, 1990). The difficulty in learning and sharing tacit technological knowledge makes it relatively difficult to adopt a complex technology. Therefore, the following hypothesis is proposed (Lin & Ho, 2011):

Hypothesis H1-1 The perceived environmental practices' complexity has a negative influence on Taiwanese logistics companies' attitudes toward environmental management practices.

Compatibility is the degree to which an innovation is consistent with the existing values, experiences, and needs of the firms (Rogers, 2003). How the new technology fits with the operational knowledge that a company already possesses and accumulates is also an important factor that influences technical innovation (Chau & Tam, 1997; Tornatzky & Fleischer, 1990). A company will be more likely to adopt the new technology that is more compatible with the company's current operational knowledge (Torantzky & Klein, 1982). Compatibility is also relevant to environmental practice adoption. Because several environmental practices are additions to companies' current processes, adoption of environmental practices is not a single event but a process of knowledge accumulation and integration. Environmental practices that are more compatible to a company's current technologies and processes will diffuse more easily within the organization. Dupuy (1997) found support for the notion that innovations that are additions to

existing technology, such as abatement equipment, are most likely to diffuse earlier than technologies that are more difficult to incorporate into the production process. Fit between previous experiences and environmental actions may generate a greater environmental effectiveness (Etzion, 2007). Therefore, the following hypothesis is proposed (Lin & Ho, 2011):

Hypothesis H1-2 The perceived environmental practices' compatibility has a positive influence on Taiwanese logistics companies' attitudes toward environmental management practices.

Relative advantage is the perception that an innovation is more advantageous than its substitute idea. The perceived benefits may consist of economic and social terms like convenience and satisfaction. Companies are more likely to adopt a technology which is able to provide better performance and higher economic gains than the other technologies. Relative advantage relates positively to the adoption of technical innovation (Rogers, 2003; Tornatzky & Klein, 1982). Potential organizational benefits of environmental practices include reduced energy and natural resource consumption, reduced waste and pollutant emission, improved environmental and financial performance, and greater responsiveness to social environmental expectation (Etzion, 2007; Hart, 1995). In a study of the Spanish pulp and paper industry, Del Rio Gonzalez (2005) suggests that economic and financial advantages are important technological characteristics that influence the adoption of clean technologies. The perceived net benefits that the environmental practice offers will serve as motivations for companies to adopt the technology. Therefore, the following hypothesis is proposed (Lin & Ho, 2011):

Hypothesis H1-3 The perceived environmental practices' relative advantage has a positive influence on Taiwanese logistics companies' attitudes toward environmental management practices.

2.2 Organizational Factors

The organizational context implies the processes and attributes that constrain or facilitate technical innovation. Several studies have discussed the influences of a variety of organizational characteristic variables such as quality of human resources, top management's leadership skills, organizational support, organizational culture and organizational size on technical innovation (Kimberly & Evanisko, 1981; Tornatzky & Fleischer, 1990), and environmental strategy (Etzion, 2007; Gonzalez-Benito and Gonzalez-Benito, 2006). This study focuses mainly on the quality of human resources, organizational support, and company size because they are widely appearing in research on technical innovation and environmental management (Lin & Ho, 2011).

The quality of human resources is an essential factor influencing technical innovation (Tornatzky & Fleischer, 1990). Qualified human resources are helpful to adopt innovations because of their competent learning and innovative

capabilities. Adopting environmental practices is a complex process requiring cross-disciplinary coordination and significant changes in the existing operation process (Russo & Fouts, 1997). The adoption process is intensive in human resources and depends on the development and training of tacit skills through the employees' involvement (Hart, 1995; Del Brio & Junquera, 2003). The recipient's lack of absorptive capacity is one of the major barriers to the transfer of technical knowledge within a firm (Szulanski, 1996). To overcome knowledge barriers to adopting environmental practices, employees need extensive, specialized training to learn the principles underlying the innovation. Employees with competent learning capabilities will be apt to increase their absorptive capacity through training programs that can advance environmental practice adoption. A company with higher absorptive capacity will be more likely to successfully implement an advanced environmental strategy (Christmann, 2004; Judge & Elenkov, 2005). Therefore, companies that have qualified human resources will benefit adopting environmental practices, and the following hypothesis is proposed (Lin & Ho, 2011):

Hypothesis H2-1 The quality of human resources has a positive influence on Taiwanese logistics companies' attitudes toward environmental management practices.

Organizational support is the extent that a company helps employees use a particular technology or system. Providing incentive for innovation adoption and ensuring the availability of financial and technical resources for innovation have positive effects on the adoption of technical innovation (Jeyaraj et al., 2006; Lee, Lee & Kwon, 2005). For the development of environmental management, organizational support is essential because the resources required for adopting environmental practices will be more easily available. Organizational support can motivate the employees to implement environmental behavior. Also, the top management plays an essential role in organizational support. Many environmental practices require the collaboration and coordination of different departments and divisions during adoption. To ensure successful adoption, the top management usually needs to endorse and encourage environmental initiatives (Gonzalez-Benito & Gonzalez-Benito, 2006). The central task of top management is to obtain resources and assemble them into organizational capabilities so that the company is able to adopt environmental practices to achieve environmental competitive advantage (Judge & Elenkov, 2005; Zhu, Sarkis, Cordeiro & Lai, 2008). Therefore, the following hypothesis is proposed (Lin & Ho, 2011):

Hypothesis H2-2 Organizational support has a positive influence on Taiwanese logistics companies' attitudes toward environmental management practices.

The literature indicates that company size is a relevant organizational factor influencing companies' technical innovation (Frambach & Schillewaert, 2002; Kimberly & Evanisko, 1981) and environmental activities (Del Brio & Junquera, 2003; Etzion, 2007; Gonzalez-Benito & Gonzalez-Benito, 2006). In general, large companies tend to adopt innovations and environmental practices more easily than

small ones because they have sufficient resources and strong infrastructures. Small companies, in contrast, may suffer from the lack of financial resources and professionals, which results in difficulties in adopting environmental practices. In addition, large companies may receive larger pressure from the society to implement environment activities because they may have a greater environmental impact on the society than smaller companies. (Gonzalez-Benito & Gonzalez-Benito, 2006). Therefore, the following hypothesis is proposed (Lin & Ho, 2011):

Hypothesis H2-3 Company size has a positive influence on Taiwanese logistics companies' attitudes toward environmental management practices.

2.3 Environmental Factors

The external environment in which a company conducts its business is another important factor affecting innovative and environmental behavior. Certain environmental variables such as environmental uncertainty, environmental munificence, governmental support, industry type, competition, and network relations commonly appear in the literature of technical innovation (Frambach & Schillewaert, 2002; Jeyaraj et al., 2006; Tornatzky & Fleischer, 1990) and environmental management (Etzion, 2007; Gonzalez-Benito & Gonzalez-Benito, 2006). This study focuses mainly on the influences of environmental uncertainty and governmental support. Also, this study investigates the influences of stakeholder pressure on logistics companies' attitudes toward environmental practices because stakeholders play an important role in organizational environment (Etzion, 2007). Stakeholder pressure is a prominent factor influencing a company's environmental strategy (Buysse & Verbeke, 2003; Sharma & Henriques, 2005).

Environmental uncertainty refers to frequent and unpredictable changes in customer preferences, technological development, and competitive behavior perceived by the managers. Environmental uncertainty is a relevant environmental characteristic that affects a firm's decision making (Li & Atuahene-Gima, 2002). Managers facing uncertain business environments tend to be more proactive and use more innovative strategies than managers in less turbulent environments. Under high environmental uncertainty, companies will attempt to gather and process information frequently and rapidly to address environmental changes (Gupta & Govindrajan, 1991), and also tend to pay more efforts on innovation and increase the rate of technical innovation to maintain a competitive advantage (Damanpour, 1991; Kimberly & Evanisko, 1981; Zhu & Weyant, 2003). Because adopting environmental practices is a technical innovation process that can improve a company's environmental performance, companies are more likely to invest in resources and adopt environmental innovations to generate the capacity to improve environmental performance in uncertain environments (Aragon-Correa

& Sharma, 2003; Rothenberg & Zyglidopoulos, 2007). Therefore, the following hypothesis is proposed (Lin & Ho, 2011):

Hypothesis H3-1 Perceived environmental uncertainty has a positive influence on Taiwanese logistics companies' attitudes toward environmental management practices.

The governments can advance technical innovation through several encouraging policies such as providing financial incentive, technical resources, pilot projects, and tax breaks (Tornatzky & Fleischer, 1990; Scupola, 2003). Adopting environmental practices relies to some extent on the availability of external resources. Munificence of resources in the business environment increases the degree to which a company engages in environmental management (Aragon-Correa & Sharma, 2003; Rothenberg & Zyglidopoulos, 2007). The government can raise the munificence by providing governmental subsidies or tax incentives for alternative energy technologies, bank financing at lower rates for environmentally friendly technologies, and lower insurance premiums for lower environmental risks (Aragon-Correa & Sharma, 2003). Lee (2008), in a study of Korean small and medium-sized enterprises, also suggests that governmental support in environmental initiatives has a positive influence on the company's willingness to participate in the environmental supply chain. Therefore, the following hypothesis is proposed (Lin & Ho, 2011):

Hypothesis H3-2 The governmental support has a positive influence on Taiwanese logistics companies' attitudes toward environmental management practices.

Stakeholders are individuals or groups who affect a company's activities and are also affected by the company's activities. Stakeholder pressure is a prominent factor influencing a company's environmental strategy and widely appears in research on environmental issues (Buysse & Verbeke, 2003; Sharma & Henriques, 2005). Traditional environmental practice adoption frameworks have repeatedly shown the strong explanatory power of stakeholder pressure. Therefore, this study also examines the impact of stakeholder pressure on adopting environmental practices for logistics companies. According to the stakeholder theory, organizations carry out activities to satisfy their main stakeholders. Among various groups of stakeholders, customers and regulators are companies' two most important stakeholders (Christmann, 2004; Etzion, 2007). Previous research has revealed that a company perceiving greater customer and regulator pressure is more likely to implement environmental activities (Christmann, 2004; Lee, 2008; Wong & Fryxell, 2004). Therefore, the following hypotheses are proposed (Lin & Ho, 2011):

Hypothesis H3-3 The perceived customer pressure has a positive influence on Taiwanese logistics companies' attitudes toward environmental management practices.

Hypothesis H3-4 The perceived regulatory pressure has a positive influence on

Taiwanese logistics companies' attitudes toward environmental management practices.

3 Methodology

3.1 Sample and Data Collection

To examine the influences of proposed factors on environmental practice adoption, data were collected by means of mailing questionnaires to logistics companies in Taiwan. Efficient logistics is one of the key success factors that makes Taiwan become an important source of electronic hardware products in the world. Five hundred samples were randomly drawn from a list of logistics companies provided by Taiwan Logistics Association. These companies were contacted via telephone to confirm the names of respondents and their mailing addresses. Questionnaires were mailed to these sampled companies' owners or senior managers who are familiar with the company's environmental activities. Two weeks after the questionnaires were mailed, a follow-up to the sampled companies was conducted to remind them of the importance of their responses and thank them for their assistance. In total, 173 completed questionnaires were returned. Of these respondents, 11 unusable questionnaires were excluded. The overall response rate is 32.4 percent. Among the respondents, approximately 80 percent of them have less than 300 employees. Most logistics companies in Taiwan belong to small and medium-size enterprises.

To evaluate the non-response bias, the wave analysis was used which assumed that late respondents tend to be more similar to non-respondents than early respondents in mail surveys (Armstrong & Overton, 1977). The non-response bias was tested by comparing respondents who responded readily to the survey with those who responded after the follow-up step was taken. Comparisons of survey results that were received after the mailing and after the follow-up revealed no significant differences between the two groups in the level of variables. Therefore, the non-response bias is not significant in the study.

3.2 Measures

Attitudes toward environmental management practices refer to the decision of a company to use the environmental practices to respond to environmental issues. Environmental logistics management focuses on filtering emission, reducing energy and natural resources consumption, reducing waste, and optimizing materials exploitation (Wu & Dunn, 1995). The environmental management practices commonly used in the logistics industry include disposing waste responsibly, purchasing ecological products, reducing energy consumption, reducing solid/water waste and emissions, using cleaner transportation methods,

and using recyclable packaging/containers (Lin & Ho, 2011; Murphy & Poist, 2003). Each sampled company was asked to score the degree of willingness to use environmental practices according to a seven-point scale anchored by "not at all" and "to a great extent".

Except the company size which was measured by the number of employees, all the other determinant factors were measured using 7-point Likert scales anchored by "strongly disagree" and "strongly agree". Table 1 shows the measurement items of each factor. Complexity was measured by whether the environmental practices would be learned and used easily (Lin & Ho, 2011; Rogers, 2003). Compatibility was measured based on the degrees of perceived fitness between the environmental practice and the company's existing technologies and processes (Lin & Ho, 2011; Rogers, 2003). Relative advantage was measured by whether the environmental practice could increase environmental and economic performance (Lin & Ho, 2011; Rogers, 2003). The quality of human resources was measured according to employees' learning and innovative capabilities (Lin & Ho, 2011; Tornatzky & Fleischer, 1990). Organizational support was measured according to the degrees of the company's resource supports and leaders' attitudes toward environment issues (Lee et al., 2005; Lin & Ho, 2011). The environmental uncertainty was measured according to the degrees of changes in competitors' innovative abilities, customers' requirement, and the development of new technologies (Lin & Ho, 2011; Zhu & Weyant, 2003). Governmental support was measured by whether the government provides financial and technical supports for adopting environmental practices (Lee, 2008; Lin & Ho, 2011). Customer pressure and regulatory pressure were measured by asking the respondents to score the environmental pressure exerted by customers and regulators, respectively (Lin & Ho, 2011).

The measurement items were submitted to factor analysis. Table 1 summarizes the factors with eigenvalues greater than 1.0. The result of factor analysis confirms the construct validity of this study. According to the reliability coefficients, the smallest value of Cronbach's alpha for this study is 0.8097, which implies that the sampling results are reliable (Nunnally, 1978). Since the single informant technique in data collection is subjected to the potential for common method bias by artificially inflating observed relationships between variables, the bias was checked using Harman's single factor test (Podsakoff, MacKenzie, Lee & Podsakoff, 2003). The analysis reveals more than one factors with eigenvalues greater than 1.0, and the first factor accounted for only about 36 percent of the variance. The common method bias does not exist in the study.

Table 1: Measurement Items for Determinant Factors

Determinant Factors	Factor Loading	Cronbach's α
Technological Factors (Total explained variance = 70.86% ; Cronbach's α = 0.8764)		
Complexity of technology		
Understanding the environmental practice is difficult.	0.843	
Learning the environmental practice is difficult.	0.810	
Sharing the knowledge of the environmental practice is difficult.	0.738	
Using the environmental practice needs many experiences.	0.689	0.8802
Compatibility of technology		
The environmental practice is compatible with our existing logistics operations.	0.793	
The environmental practice is consistent with our company's values.	0.748	
Integrating the environmental practice with company's existing system is easy.	0.697	0.8593
Relative advantage of technology		
The environmental practice can provide better environmental performance.	0.807	
The environmental practice can provide higher economic benefits.	0.762	
The environmental practice can enhance our company's reputation.	0.701	0.8817
Organizational Factors (Total explained variance = 65.32% ; Cronbach's α = 0.9118)		
Quality of human resources		
Employees can learn new technologies easily.	0.806	
Employees can share knowledge with each others.	0.758	
Employees can easily use new technologies to solve problems.	0.719	
Employees can provide new ideas for our company.	0.663	0.9043
Organizational support		
Top management encourages employees to learn environmental practices.	0.851	
Our Company provides rewards for employees' environmental behavior.	0.818	
Our company provides resources for employees to learn environmental practices.	0.737	
Top management can help employees when they face environmental problems.	0.682	0.9176
Environmental Factors (Total explained variance = 62.57% ; Cronbach's α = 0.8475)		
Environmental uncertainty		
Predicting customers' preferences is difficult.	0.793	
Predicting competitors' behavior is difficult.	0.752	
The advance in new logistics service modes is quickly.	0.708	
Customers' preferences vary frequently.	0.621	0.8097
Governmental support		
Government provides financial support for adopting environmental practices.	0.846	
Government provides technical assistance for adopting environmental practices.	0.812	
Government helps training manpower with environmental logistics	0.735	0.8739

skills.		
Customer pressure		
Our customers require us to improve environmental performance.	0.813	
Caring for the environment is an important consideration for our customers.	0.739	0.8174
Regulatory pressure		
Government sets environmental regulations for logistics operations.	0.841	
Industrial associations require us to conform to environmental regulations.	0.748	0.8326
		Total Cronbach's α = 0.8693

4 Results and Discussions

The regression analysis was used to determine whether proposed technological, organizational and environmental factors will influence Taiwanese logistics companies' attitudes toward environmental management practices. The study takes the ten determinant factors as independent variables and the attitudes toward environmental management practices as the dependent variable in the regression model. Table 2 shows the standardized results of regression analysis. The regression results support the hypotheses about technological factors, H1-1, H1-2, and H1-3.

The significant results suggest that perceived complexity, compatibility and benefits of environmental practices will affect the attitudes toward environmental management practices. Companies will be more likely to adopt a environmental practice when they perceive that the practice is less complicated, easier to learn and use, more compatible to their existing business operations, and helpful for improving environmental and economic performance. Similar results can also be found in our previous study (Lin & Ho, 2011) for the green practice adoption for logistics service providers in China.

To reduce the complexity of environmental practices, companies can attempt to increase the explicitness of environmental practices that is helpful for the transfer and learning of related knowledge within an organization. Increasing the explicitness of knowledge can also help companies appreciating the compatibility of the environmental practices. As a result, companies are able to select a environmental practice that is more consistent with their existing system. In addition, companies will be more capable of reducing perceived complexity and increasing perceived compatibility through accumulating more environmental knowledge. During the process of accumulating environmental knowledge, companies will not only have more related experiences that are helpful for reducing the perceived complexity of environmental practices, but also adjust their values and operations towards environmental-friendly that advance the compatibility between companies' existing systems and new environmental practices.

Table 2: Standardized Regression Results

Dependent variables: Attitudes toward Environmental Management Practices		
Predictors	Standardized Coefficient β	*t*
Technological factors		
Complexity of technology	-0.124	-2.109*
Compatibility of technology	0.184	3.274**
Relative advantage of technology	0.187	3.986**
Organizational factors		
Quality of human resources	0.179	2.979**
Organizational support	0.201	4.211**
Company size	0.126	2.347*
Environmental factors		
Environmental uncertainty	-0.074	-1.084
Governmental support	0.183	3.315**
Customer pressure	0.098	1.241
Regulatory pressure	0.175	2.843**
R^2	0.617	
adj R^2	0.592	
F	24.33**	
Durbin-Watson value	1.703	

* $p<0.05$ ** $p<0.01$

The relative advantage is a relevant technological factor influencing environmental practice adoption. The perceived net benefits, including improved environmental and economic performance, and better reputation, that the environmental practice offers will serve as motivations for companies to adopt the environmental practices. Del Rio Gonzalez (2005), in a study of the Spanish pulp and paper industry, also suggests that economic and financial advantages are important technological characteristics that influence the adoption of clean technologies. Therefore, to advance environmental practice adoption, firms who provide environmental technologies, equipments and services for their clients should put more effort to make their customers appreciate the relative advantage of the practices.

The regression results also support the hypotheses about organizational factors, H2-1, H2-2, and H2-3. The significant results suggest that qualified human resources, organizational support, and company size will affect environmental practice adoption behavior. In summary, employees' learning capabilities and the availability of resources are relevant for the adoption of environmental practices. Use of environmental practices may add complexity to

production or delivery processes and require an amount of learning and training programs. In a study of logistics managers' perspectives of environmental issues, Murphy and Poist (2003) also suggest that increasing education and training of employees is one of the strategies for managing environmental issues. The education and training effects often relate positively to qualified human resources with better learning capabilities. To improve organizational learning capabilities, companies can recruit qualified employees, provide educating programs, and build knowledge management systems. On the other hand, the process of adopting environmental practices can build within a firm the resources of organizational commitment and learning, cross-functional integration, and increased employee skills and participation, which are emerging as prime resources in a competitive environment (Russo & Fouts, 1997).

The present result provides further evidence on the importance of organizational support, especially top management support, in environmental innovation. Organizational support gives employees motivation and resources to adopt environmental practices. Murphy and Poist (2003) address that lack of top management support is a major obstacle to establishing environmental policies for logistics companies. The present result also reveals that company size will influence the propensity to adopt environmental practices. Larger companies are more likely to adopt environmental practices than smaller ones. Larger companies usually have more technical and financial resources as well as better human resources than smaller companies to adopt environmental practices. To advance smaller companies' environmental commitment, the governments and industrial associations can attempt to provide them with sufficient technical, financial and educational resources (Lin & Ho, 2011).

Regarding the influences of environmental factors, the regression results only support hypotheses H3-2 and H3-4, and do not support the hypotheses H3-1 about environmental uncertainty and H3-3 about customer pressure. The significant results suggest that governmental support and regulatory pressure will affect environmental practice adoption behavior. The government plays an important role in advancing environmental practice adoption. In general, a body of research has concluded that governmental regulation is a main driver for environmental management. Government intervention promoting greater environmental regulation is important in the development of logistics industry. However, in addition to setting up environmental regulations, the present result reveals that the government should put more effort in encouraging and guiding logistics companies to adopt environmental practices. Both regulatory push and pull effects will drive environmental practice adoption. Most logistics companies in Taiwan are small and medium-size enterprises, and may suffer from the lack of financial and technical resources and qualified professionals. Governmental support is essential for smaller companies in developing environmental management (Del Brio & Junquera, 2003; Lee, 2008; Noci & Vergandi, 1999). Providing economic or political incentive, reducing long-term uncertainties, providing flexibility and stimulating industry-generated information are the

essentials of governmental policies that have the ability to advance environmental innovation (Norberg-Bohm, 1999). Well-designed environmental policies can stretch firms beyond current practices and grant them flexibility to meet the environmental goals (Kassinis & Vafeas, 2009).

The study initially expects that environmental uncertainty may stimulate logistics companies' intention to adopt environmental practices. However, contrary to the proposed research hypothesis, the finding reveals a non-significantly negative relationship between environmental uncertainty and environmental practice adoption. This result may be due to that most environmental approaches could produce positive economic returns only in the long term (Etzion, 2007), and most logistics companies in Taiwan are small and medium size. Environmental uncertainty may affect the type and amount of resources needed in the resource portfolio, the capabilities necessary to outperform rivals, and the leveraging strategies required to gain and maintain a competitive advantage (Sirmon, Hitt, & Ireland, 2007). While facing uncertainty environments, smaller companies with limited resources will be difficult to develop long processes of competence accumulation and allocate resources to environmental initiatives (Del Brio & Junquera, 2003). Smaller companies may tend to develop a short term mentality concerning their return on investments and avoid prolonged technological experimentation along different technological paths. These companies may delay environmental technology investments until they have changed and improved their primary operation and productive processes (Rothenberg & Zyglidopoulos, 2007). Therefore, when logistics companies perceive a high degree of uncertainty in their business environment, they may put more resources on improving their primary business activities rather than on improving their environmental performance.

Another interesting finding is the non-significantly positive association between customer pressure and logistics companies' adoption of environmental practices. Similar results are also found in our previous study in China (Lin & Ho, 2011). Most research on environmental issues addresses that customers are important stakeholders for a company and their pressure significantly affects a company's environmental activities (Etzion, 2007; Gonzalez-Benito & Gonzalez-Benito, 2006). The present non-significant result may be due to the position in the supply chain that logistics companies stand. Within a supply chain, the proximity to the final consumers is an important factor influencing a company's environmental activities. Although empirical evidence is scarce, some researchers argue that customer pressure is high for the manufactures of finished products (Gonzalez-Benito & Gonzalez-Benito, 2006; Buysse & Verbeke, 2003). The intermediates who are not directly involved in the manufacturing of products often respond to less pressure from external stakeholders consuming the products. Logistics companies provide product delivery services for their customers who are the manufactures and consumers of the products in the supply chain, and do not directly involve in the manufacturing of products. Most logistics companies' customers may perceive the environmental impact of their products, but are less

interested in logistics companies' environmental performance. They may concern more about the delivery efficiency of logistics companies. Therefore, the positive influence of customer pressure on logistics companies' environmental practice adoption is not significant in the present study. The finding may provide further empirical evidence that the position standing in a supply chain will influence a company's environmental activities.

5 Conclusion

Based on a survey of logistics companies in Taiwan, this study concludes that complexity, compatibility and relative advantage of environmental practices, quality of human resources, organizational support, governmental support and regulatory pressure exhibit significantly influences on Taiwanese logistics companies' attitudes toward environmental management practices. The influences of environmental uncertainty and customer pressure on logistics companies' environmental behavior are not significant. To advance environmental practice adoption, companies can attempt to increase the explicitness of environmental practices, improve their organizational learning capabilities, and make organizational resources easily available for their employees. In addition to being a regulator, the government should provide sufficient financial, technical and educational resources for companies to adopt environmental practices. So far, most studies of environmental issues have focused on manufacturing sectors, and pay less attention to the service sectors, like the logistics industry. This paper contributes to an insight into the environmental management issues in the logistics industry.

Owing to the using of questionnaire survey, the results of this study may suffer from the respondent bias. Participants may modify their responses to be socially acceptable or to appear rational and logical. Nevertheless, the fact that the survey was voluntary and anonymous may have minimized this problem to some extent. In addition, a study on the environmental practice adoption of Taiwan's logistics companies may limit the generalizability of the present research findings. Different countries and industrial sectors may lead to conclusions different from the present study. Future studies can use the proposed model to other countries and industrial sectors, and can also consider additional technological, organizational and environmental factors.

ACKNOWLEDGEMENTS. We are grateful to the National Science Council of the Republic of China for the financial support of this work under the grant NSC 98-2410-H-309-005.

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