Impact Evaluation of the Environmental User Fee System: A Stakeholder Perspective

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EXECUTIVE SUMMARY

Since the implementation of the Environemental User Fee System (EUFS) in the Laguna de Bay Region in 1997, there has been no comprehensive evaluation of its impacts particularly at the regulated firm level. This study, therefore, is an attempt to generate empirical evidence that could explain the differential behavior of regulated firms toward the EUFS. The emphasis of analysis is at the firm level, since firms are crucial stakeholders whose cooperation spells the difference between pollution or non-pollution, or between acceptable levels of pollution and excessive levels.

The sources of information for this study include: a) a survey of 89 firms regularly monitored by the Laguna Lake Development Auhtority (LLDA) from 1999-2004; b) 170 firms with self-monitoring reports (SMRs) for 2002 and environmental performance indicators for 1999-2004; and c) dissemination seminars for firms and the regulator.

Using a conceptual framework modified from Doonan, et al. (2002), environmental performance is modeled (using the EQS 6.1 Build 88) as a series of events wherein different sources of pressure induce firms to undertake activities and actions which subsequently affect the firms' environmental performance. Compliance rate (%) to the standard of 50 mg/li Biological Oxygen Demand (BOD) was used as a measure of ernvironmental performance.

Firms perceive that governments, in general, are the main source of pressure for pollution abatement. Clients and the EUF are the second and third important source of pressure, respectively. Statistical analysis and data trends for the surveyed 89 firms and the 170 firms showed that in general, the EUFS has been successful in inducing firms to improve their environmental performance. This is specifically reflected by the decreasing trends in the average EUF and variable fees paid as well as in the BOD loading and concentration over the period 1999-2004. More importantly, 75% of the 89 sample firms are not simply complying with the standard but are actually, on average, performing 80% better than the standard. Other impacts include reduction in the volume of wastewater discharges; installation of wastewater treatment facilities; and reduction, substitution or elimination of harmful chemicals in response to the regulation.

Given the above findings, the good news is that firms have responded positively to the EUFS. The bad news is, it is a very costly response that makes the regulated firms less competitive. Compliance rates can be further improved and compliance costs can be potentially reduced. Entry points for policy intervention include a restructuring of the user fees, provision of information on the more appropriate abatement technology, and harmonization of laboratory testing processes or procedures.

IMPACT EVALUATION OF THE ENVIRONMENTAL USER FEE SYSTEM: A STAKEHOLDER PERSPECTIVE

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1.0 INTRODUCTION

Laguna de Bay is the Philippines' largest lake and Southeast Asia's second largest freshwater lake with a total surface area of 900 sq. kms. (Nepomuceno, 2004). To date, environmental protection is being accorded to the lake owing to the crucial economic benefits such as being an important source of domestic water supply and fishery activities. These benefits, however, are threatened by water pollution arising from rapid urbanization and industrialization. Thus, in 1997, the LLDA embarked on the use of a market based instrument - the Environmental User Fee System (EUFS) - which was introduced in the Laguna de Bay Region by the Laguna Lake Development Authority (LLDA). The direct impact of an environmental user charge is on the behavior of the economic agent to whom the charge is assessed. The heart of pollution abatement behavior is at the level of the firm. From such behavior, the desired effects on environmental quality can be deduced. Since the implementation of this pollution charge program that was initiated to complement the existing command and control regulatory approach, there has been no comprehensive evaluation of its impacts particularly at the regulated firm level. Although various reengineering studies have been commissioned in the past, (SDLBEP, no date; Tetra Tech EM, Inc., 2001) such studies mainly focused on the improvement of regulatory instruments and approaches (e.g., refinement and expansion of the EUFS coverage) and the strengthening of LLDA's policy and planning functions (Korea Environment Institute, 2004 as cited inLISCOP Final Inception Report, 2004). Thus, it may be said that the inclination of past studies in the light of assessing the impact of the EUF has generally been toward the traditional "top-to-bottom" approach.

This paper asserts the importance of conducting an evaluation of the same market-based instrument but from the viewpoint of an important stakeholder, the regulated firms. The value of this study lies in generating empirical evidence that could explain the differential behavior of regulated firms toward the environmental user fee. Regulatory agencies like the LLDA will certainly benefit from information and analysis that sheds more light as to why some firms undertake various levels of investment on pollution abatement measures in response to the implementation of the pollution charge while others do not. In addition, LLDA stands to gain from knowing what works and what does not work for polluting firms that induce them to internalize negative externalities they create or persist to engage in environmentally damaging behavior. Results from this study will also serve as valuable input to LLDA's current thrust of reforming and expanding the EUF in the Laguna de Bay Region.

2.0 RESEARCH PROBLEM

Laguna de Bay is the Philippines' largest lake and Southeast Asia's second largest freshwater lake with a total surface area of 900 sq. kms. Intensified environmental protection accorded to the lake stems from crucial economic benefits that includes being an important source of domestic water supply and fishery incomes. Such benefits, however, are threatened to be eroded by water pollution arising from rapid urbanization and industrialization. An estimated 4 million metric tons of suspended solids flow into the lake, with an average accretion of 0.5 cm per year (Nepomuceno, 2004). Pollution from industries accounts for about 21% of the total organic loading into the lake and since 1970, industries have grown by as much as five-fold.

In response to the need to curb further water quality deterioration, the LLDA, in 1997, embarked on the use of a market based instrument (MBI) - the Environmental User Fee System (EUFS)- which was introduced in the Laguna de Bay Region. The EUFS is actually a "model of mixed regulatory and economic instrument for pollution prevention and abatement in the context of lake/river basin management (Nepomuceno, 2004). The only pollutant for which regulation was made is the biochemical oxygen demand or BOD loading. The annual user fee consists of a fixed fee that covers administrative costs of the program and a variable fee that is based on BOD loading.

According to LLDA records, there are about 2,890 establishments in the Laguna de Bay Region which are classified as 'wet' industries that can be potentially covered by the system. As of July 2004, the coverage of the EUFS, however, has been limited to only 1,340 firms because the rest are considered "exempted" since those firms have average discharge flows that are below the legal minimum of 12 cu.m for which regulations have been set. During the first three years of implementing the EUFS, the ratio of actual collection to total assessed fees (or the collection efficiency) was only 50% on average. The large volume of transactions could not be processed efficiently with the limited monitoring, assessment and billing system (LISCOP Final Inception Report, 2004). With its regular implementation from the fourth year onwards, the total number of firms covered by LLDA was 914 as of December 2002. BOD loading into the lake is said to have significantly decreased from 1997 to 2002. This was attributed by LLDA to a host of factors that include the setting up/upgrading of treatment facilities, wastewater recycling activities, adoption of waste minimization strategies and voluntary closure or plant relocation. Incidences of dilution among firms, however, were reported. (Nepomuceno, 2004).

Since the implementation of the EUFS in 1997, there has been no comprehensive evaluation of its effectiveness particularly at the industry or firm level. Although various reengineering studies have been commissioned by LLDA in the past, (LISCOP Final Inception Report, 2004; SDLBEP, no date; Tetra Tech EM, Inc., 2001) such studies largely focused on the improvement of regulatory instruments and approaches (e.g., refinement and expansion of the EUFS coverage) and the strengthening of LLDA's policy and planning functions (Korea Environment Institute, 2004 as cited in LISCOP Final Inception Report, 2004). Thus, it can be said that the direction and approach of past assessment studies had generally been from "top-to bottom".

In the light of LLDA's mandate "to promote and accelerate the balanced development of the Laguna de Bay Region with due regard for environmental

management and control", it will serve an equally important purpose to be able to elicit empirical information and analysis on the response of firms to this environmental regulation. Gaining their insights and perceptions about the effectiveness and implementation of the EUFS will prove quite useful inputs in LLDA's current thrust of further refining and improving this economic instrument.

Given the foregoing, it is but timely and relevant to ask: What have been the impacts of the user fee on the environmental performance of regulated industries? How effective a regulatory instrument has been in inducing changes in the pollution abatement behavior of firms over time? What are the various sources of pressure that regulated firms face in improving their environmental performance? Is the EUF a source of pressure?

This paper is, thus, an attempt to provide useful insights to the above queries. The emphasis of analysis is at the firm level, since firms are crucial stakeholders whose cooperation spells the difference between pollution or non-pollution, or between acceptable levels of pollution and excessive levels.

3.0 REVIEW OF RELATED LITERATURE

3.1 Use of Market-Based Instruments

Economic instruments such as emission and effluent charges are said to be the most commonly used in developing and transition countries. But more often than not, these charges have been set at quite low levels, and with the unsystematic enforcement of such instruments, the result has been such that they did not really have much impact on the behavior of polluting firms. Neither were they effective enough in raising revenues, with the exception of Poland's case. (World Bank Group, 1998). In a study of Zagreb on the policies and trends of water pricing in Croatia, a recent assessment carried out by Hrvatske vode experts (a government agency for water management) indicated that the present fee is four times lower than the actual costs of waste water motivating the polluter to maintain the status quo, rather than invest in new waste water treatment plants. On the other hand, success factors for the water pollution charge in the Netherlands and sulfur tax in Sweden include, among other things, a) setting charges or taxes at high enough levels to provide for full cost recovery of treatment; b) using a charge base (e.g., BOD and heavy metal pollution for water pollution charge) that is directly linked to pollution load of large firms; c) decentralizing the charge program and making it transparent for water and air users; d) setting transparent rebate scheme to strengthen incentive effects of taxation and e) easy implementation and low administrative costs, with burden of proving actual emissions level imposed on polluters (Opschoor et al., 1994 as cited in World Bank Group, 1998).

Baumol and Oates (1988) state that, theoretically, emission charges are the best way to alter the behavior of economic agents and internalize the social costs of pollution if they are set at levels equal to the marginal environmental damage or marginal abatement costs. Furthermore, the ultimate level of effluent charges should be high enough as to "provide an incentive for a targeted level of pollution abatement within an area or watershed over time".

In the real world, however, there may be constraints to the effective implementation of user charges. Unless the enabling macroeconomic and environmental policy framework are in place, the success of pollution charges would be a remote possibility. Where output markets are distorted to the extent that polluters who have monopoly power can pass the costs of abatement on to consumers and when there is no pressure to adopt alternative solutions, user charges can be rendered ineffective. Markets for environmental services that offer alternative options must also be well-developed; it is unfortunate, though, that such is not the usual case in the domestic markets of developing countries. General economic and political stability is also an important enabling factor for the effectiveness of pollution charges. Lastly, environmental regulatory agencies must have the institutional capacity and the will to enforce regulations, with strong legal and political support as well as consensus among major stakeholders. The major stakeholders referred to are the environmental agencies, the industries subject to the pollution charges, and the communities that are affected by the pollution. The awareness and participation by the public and community pressures through NGOs can also be a powerful enforcement tool. The long-term success of economic instruments also needs "systematic measurement of their performance, either through self-examination or through external oversight" as these can provide the necessary feedback (World Bank Group, 1998).

Qinghong Pu (2003) evaluated the effectiveness of existing pollution control strategies in the Yangtze Region and explored the strategies that can effectively control industrial water pollution in the Yangtze River. He found out that although the current pollution control strategies and informal forces have jointly produced a positive water pollution control outcome in the Yangtze River, there is still considerable room for promoting their effectiveness. His paper suggested developing the integration of strategies that emphasize the synergy of command-and controls, market-based instruments and informal instruments and the cooperation of government, communities and polluters.

In their paper which investigated the enforcement and effectiveness of China's pollution levy system, using factory- level data of 3,000 firms, Wang and Wheeler (1999) found that there is considerable scope in the use of economic instruments to improve the problem of industrial pollution in China. In their study, the factors that significantly affected both water and air pollution charges include ambient quality and plant characteristics. State-owned plants pay less but large, old firms and those with positive profit pay high levy rates. Across industry sectors, building materials and paper have low water levies in contrast to petroleum production. Citizen complaints have a positive significant impact on air pollution levy but not on water levy. The air levy's greater impact is through the production process adjustment while that for water levy was through the end-of pipe abatement.

In the paper of Allen Blackman (2005), which looked at Columbia's discharge fee system, he found that that the program has been beset by a number of serious problems such as (1) limited implementation in many regions, (2) widespread noncompliance by municipal sewage authorities, and (3) a confused relationship between discharge fees and discharge standards. Nevertheless, pollution loads dropped significantly after the program was introduced in several watersheds. While proponents of Columbia's discharge fees program claim the incentives that discharge fees created for polluters to cut emissions in a cost-effective manner were responsible for this success, the paper argues that the incentives they created for regulatory authorities to

improve permitting, monitoring, and enforcement, by enhancing transparency and accountability and by creating financial incentives for strict enforcement, were at least as important.

On the other hand, the U.S. EPA findings of the Industrial Pollution Prevention Project (IP3) cited four general motivators as most important for pollution prevention in industries, namely: 1) economics; 2) technical and financial assistance; 3) open communication; and 4) flexibility ("especially regulatory flexibility"). The key factor triggering pollution prevention is stringent regulation with enforcement action. Industries desire to avoid being subject to regulations (EPA, 1995). Compliance to environmental regulations is also perceived to enhance the company's public image and protect public health, thus, serving as an important driver for industrial pollution prevention (Shen, 2000).

3.2 Determinants of Environmental Performance

Magat and Viscusi (1990) made an empirical analysis of the impact of U.S. EPA inspections on the discharges of the pulp and paper industry in the U.S. and found that inspections served as deterrents against non-compliance.

Hua Wang (2000) evaluated the degree of influence of community pressure and pollution charge on industrial pollution control in China. An industrial organic water pollution discharge model was constructed and estimated using Chinese data on plant-level organic water pollution from those industrial plants violating discharging standards. This model includes both formal and informal (community) regulations. The results of the estimation affirmed that both formal and informal (community) variables are indeed significant determinants of the water pollution discharge behavior. Furthermore, it was seen through a conservative estimation that both formal and informal regulations are almost of the same strength. The study was also able to prove that Chinese pollution levy system has been quite effective in providing incentives for most industries which are violating water pollution discharge standards.

The environmental performance of firms is strongly influenced by both internal and external pressures. In his theory of rational crime, Gary Becker (1968 as cited by Nyborg and Telle (n.d.) stated that a profit-maximizing firm will comply with an environmental regulation only as long as the expected penalty of violating exceeds the compliance cost. There have been disputes about the impact of monitoring and enforcement on compliance of polluting firms. Harrington's analysis of monitoring, enforcement and compliance with environmental regulations in the US in the 1970's and 1980's suggested that compliance is higher than predicted by standard theory. Nyborg and Telle (n.d.) however, claims that there is lack of evidence from other studies to confirm what has been labeled as the "Harrington paradox".

Recent studies attempted to determine the factors which hinder the successful compliance to environmental policies promoting the adoption of clean technologies. Corral (n.d.) analyzed the determinants of a firm's willingness to adopt or develop cleaner technologies. Reviewing the literature, he identified three categories of recurrent

determinants according to the frequency and degree of importance given to the factors mentioned.

The first group is composed of factors arising from social norms. These include public and shareholder pressures, regulations enforcement, market demand, community concerns, customer demands, liability, public image and social responsibility, etc. The second set of factors is cognitive and attitudinal such as perceptions, personality, efficacy, leadership, and environmental awareness and the ethics of managers and CEOs. Other factors included in this group are economic efficiency and opportunity, and the risk and uncertainty of the innovative process. Lastly, the third group involves the technological factors believed to hamper the "greening" of industry. Recurrent factors include the lack of technological opportunities and the necessity of generating a new knowledge base prior to attaining a sustainable industrial development; the industrial and trade relationships across the supply chain; the relation between end-users and suppliers; the firms' technological and organizational endowments; technological trajectories, etc.(Corral, 2001). Many as they are, only a few of these studies were quantitative in nature.

Using the theory of social change as basis and a case study of the In-Bond industry (Maquila), Corral 2001 tested the relationship between the willingness of a firm to innovate/adopt clean technologies and three sets of determinants: attitude towards innovation, social pressure and control over innovation.

The firm's attitude (A) toward the development of cleaner technologies is defined as the degree to which the firm's manager expects good or bad outcomes from the performance of such behavior. The firm's perceived social pressure (PSP) refers to the importance that the firm's manager gives to different important referents. Lastly, the firm's perceived control over the development of cleaner technologies (PC) focuses on the management beliefs about how much control their organization can exert over the innovation process to develop cleaner technologies.

The determinants of the firm's attitude toward the development of cleaner technologies are the environmental and economic risks perceived by the managers. On the other hand, the determinants of social pressure include environmental regulations, industrial standards (ISO), market position, market forces, customer expectations and demands, and public concerns. These can be summarized as the regulatory regime, the market pressures, and the perceived lobbying capacity of the community. As for the determinants of the perceived control, these include organizational learning (OL), strategic alliance (AL), networks of collaboration (NWK), and technological capabilities (TC).

Among the determinants, the technological capabilities (39.8%) and the perceived economic risk (21.38%) accounted for the major part of the variance in the willingness to innovate. However, these factors are moderated by the perceived control over innovation i.e. the higher the capabilities, the lower the perceived economic risk and the higher the willingness. The results suggested that optimal policy scenarios arise only from high technological capacities of firms and that high social pressure to develop clean technologies are not sufficient to motivate firms to innovate. The results further suggest that there are better ways of promoting better environmental performance than through direct regulation.

Contrary to Corral's (2001) conclusions, Doonan, et al. (2002) asserts the crucial role of strong government regulatory intervention as exerting pressure on firms to improve their environmental performance. Their findings are based on a survey of 101 environment directors of pulp and paper plants in Canada.

Using results from the survey, the authors developed a linear structural equation model in which the exogenous and endogenous variable are proxied by a series of observed indicators combined through principal component analysis.

The authors grouped the various sources of pressure into four categories: legal, economic, social, and internal. The nature of the environmental regulation faced by the enterprises is the legal source of pressure. This would include both the stringency and extent of implementation of the regulation. The economic source of pressure includes: providers of financial capital (investors and creditors); customers; suppliers; and competitors. Community and non-governmental organizations represent the social sources of pressure. Finally, the management and the employees serve as the internal sources of pressure.

These sources of pressure for the firms are forcing them to undertake several actions to improve their environmental performance. These actions, like the sources of pressure, are also grouped into five broad categories. First is involvement, which refers to the level of involvement of top management in the environmental affairs of the company. Second is integration, which represents the level of integration between the environmental services and the other administrative units of the industrial facility. Third are the human resources, which capture how human resources management takes into account environmental issues. Fourth is the financial resource, which refers to the physical and financial resources devoted to the improving and maintaining of the environmental performance of the facility. Last is the monitoring system, which represents the facility's environmental performance monitoring activities and system.

On the other hand, environmental performance of the industrial facility was measured using six variables. These are BOD and TSS effluent emissions, spills, use of chlorine, fines and penalties, air emissions, and the use of alternative sources of energy.

Results of the analysis showed that the three most important sources of pressure perceived by the environmental directors are the government, the general public and the higher level of management. Their findings are consistent with those of Deschamps and Beaulieu (1996) who assert that the environmental involvement of top management is a primary determinant of environmental performance.

It was also noted that the way in which environmental issues are taken into account in human resources management also influences environmental performance through its impact on the level of integration. This result is consistent with that of Boiral and Dagupta, et al (1997) who associated the level of environmental training with better environmental performance.

The level of integration between the environmental services and the other administrative units had an indirect effect on the environmental performance through its impact on the monitoring system and the financial resources devoted to the environment. The environmental performance monitoring system has an indirect impact on environmental performance through its effect on the level of financial resources. The latter is the most important factor affecting environmental performance

because in the paper industry, environmental performance relies on the use of extensive and expensive pollution abatement devices.

While majority of studies analyzed the determinants of willingness to comply, Corral (n.d.) recommends changing the focus of environmental policies towards determinants of resistance to behavioral change. Theories on self distribution and power assumes that self-interest (i.e. profit seeking) explains per se firms' behavior towards compliance with regulations and development of clean technologies. These theories, however, do not explain the conditions under which incentive-based instruments designed to promote environmental protection could be implemented.

Dissertation work on contested enforcement of the EUF was done by Montenegro (2006). She made use of monthly water pollution discharges from panel data from 1997-2004 of 16 beverage and pulp and paper mills regulated by the LLDA. Her data were taken from the quarterly self-monitoring reports (SMRs) submitted by firms to LLDA. The main objective of her study was to undertake an empirical analysis of how contested enforcement impacts firms' environmental performance. Contested enforcement here is proxied by the number of case dismissals plus other legal enforcement actions . Using a single-equation random effects model, she found that the significant factors that positively affected levels of BOD and TSS were compliance cost, firm size and existence of pulping processes. Lagged enforcement and inspection variables had no significant effect on environmental performance. However, enforcement intensity significantly influenced the levels of BOD and TSS.

4.0 RESEARCH OBJECTIVES

4.1 General Objective

To analyze the impact of the environmental user fee on industries' environmental performance, from firms' own perspective.

4.2 Specific Objectives

To provide an historical background on the institution and mechanics of the environmental user fee system (EUFS);

To analyze the sources of pressure and other factors that enhance or limit the firms' environmental performance;

5.0 RESEARCH METHODS

5.1 Research Questions to be Answered

From the point of view of firms, what have been the impacts of the user fee on the environmental performance of regulated industries?

How effective a regulatory instrument has been in inducing changes in the pollution abatement behavior of firms? What are the other determinants of pollution abatement behavior of firms?

What are the sources of pressure that influence firms' environmental performance?

What courses of action have firms made in response to the EUFS?

5.2 Hypotheses of the Study

The EUFS is an effective instrument for inducing changes in pollution abatement behavior of regulated firms.

Various sources of pressure directly affect environmental performance.

The commitment of top level management is a significant determinant of firms' environmental performance.

Investment on physical and human capital increases the firms' compliance rate.

The level of firms' monitoring activities positively affect compliance rate.

5.3 Sampling Procedure

To be able to generate emprical evidence and analyze the impact of the EUFS on pollution abatement behavior of regulated industries, the study initially set out to survey 150 firms, randomly selected from a population of 177 stand-alone industrial firms that LLDA regularly monitored from 1999-2004. Although the present count of LLDA-monitored firms is already more than a thousand, it is strongly believed that this group of 177 firms that had been regularly monitored in the last six years are in the best position to talk about how the user charge has affected them. From this population, a stratification was done based on a) the type of industry subsector and b) the volume of wastewater discharge. The survey of firm managers and/or pollution control officers was done from November 2005 to May 2006. Some respondents preferred to be interviewed face to face. For the majority of the firms, however, the survey instrument was dropped off and collected some weeks after. The focus was only on industrial sectors that faced the EUF and had to pay the EUF. A toal of 89 firms (or a response rate of 50%) have responded to our survey and they constitute the final sample used in this study.

5.4 Other Sources of Data

The field survey is important and useful for eliciting descriptive information on the perceptions of the regulated firms with regard to the impacts of the EUFS. It also provides qualitative assessment of the sources of pressure that are perceived by firms to influence their actions and activities that consequently bear on their environmental performance.

However, because of the cross-section nature of the field survey, not much trend and other quantitative analysis of the EUFS impact can be done. To complement the survey, firm-level time series data (1999-2004) on the wastewater discharge, BOD and EUF of 270 firms were accessed from LLDA. Another set of data accessed for analysis was the self-monitoring reports (SMRs) for the year 2002[1]. The information contained in the SMRs were intended to be used as basis for characterizing and differentiating compliant firms from non-compliant firms.

5.5 Conceptual Framework

Environmental performance is modeled as a series of events wherein different sources of pressure induce firms to undertake activities and actions which subsequently affect the firms' environmental performance (Doonan et al 2002) . The details of this framework are shown in Figure 1.

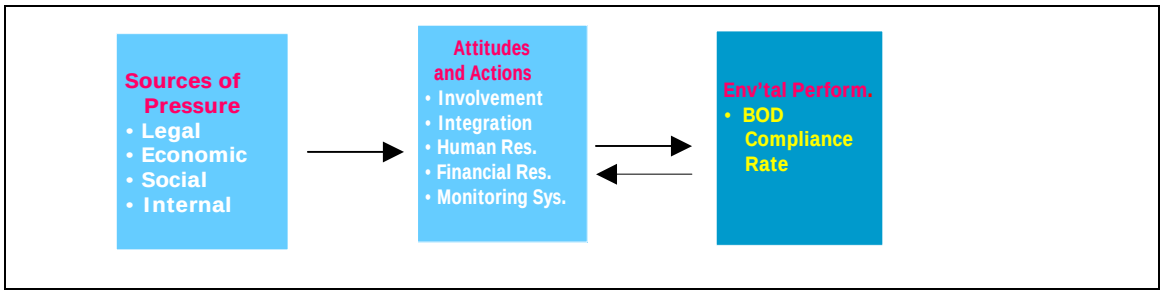

Figure 1. Conceptual Framework Modified from Doonan et al. (2002)

Pressures can be proxied by the ranking of managers of impact of each source of pressure. Sources of pressure are latent exogenous variables that may be proxied by some other indicators and combined using principal component analysis . For instance, *legal* pressures that refer to influence of enforced regulations on firms' environmental practices can be measured, among other things, by the number of regulatory inspections as well as by the number of compliance violations and enforcement actions taken against the firm. *Economic* pressures which capture the influence of providers of financial capital (e.g., investors and creditors, customers, suppliers and competitors) can be measured by a) customers' consideration of environmental management in selecting suppliers; b) market outlet (export or domestic); c) perceived competitors' adoption of environmental services; d) industry associations; e) market share of each industry; f) type of good sold (intermediate or final good); and g) market concentration. *Social* pressure is represented by the influence of communities, environmental interest groups and non-government organizations and may be measured by a) the number of community complaints against the firm**;** b) proxy for propensity for collective action such as voter turnout in recent elections; c) demographics such as average household income and population density; d) community environmental activism as represented by proportion of population proximate to each firm. *Internal* sources of pressure is captured by influence of management and employees characteristics and can be measured by a) ownership of firm (% equity, whether foreign, private or government);

[1] The more recent SMRs could not be accessed since LLDA was using them as basis for assessing the user fees to be charged to firms for 2005.

b) legal classification of firm (single proprietorship, partnership, private or public corporation, multinational); c) firm listing in stock market; d) market leadership/market share; e) brand reputation of parent company; f) and existence of employees' unions.

The ways in which environmental managers perceive the various sources of pressure discussed above will have some impact on the attitudes and lines of action taken by the firms with regard to improving environmental performance. These attitudes and actions are thus grouped into five categories. *Involvement* of top management in the environmental affairs of the firm can be represented by the existence of high position for environmental concerns and inclusion of a seat in the board of directors fro an environmnet committee. Integration between environmental services and the various administrative units of the firms can be probed by asking questions on a) the existence of EMS; b) joint employer-employee committee on environmental issues; c) firms' intention to secure ISO 14000 certification; d)frequency of contact between environment director and managers of other units; e) consideration of environmental issues in making major changes or plans in the firm; and f) involvement of employees in the formulation and discussion of environmental policy. *Human resources* capture how personnel management considers environmental issues This can be indicated by the provision of environmental training across types of employees and consideration of environmental performance in the compensation package and performance evaluation of employees. *Financial resources* represent the physical and financial resources allotted to improving and maintaining environmental performance such as information on budget and personnel devoted to research on environmental issues within the firms, budget and number of people assigned to environmental services, existence of secondary treatment systems, etc. *Monitoring system* represents the facility's environmental performance monitoring system and activities. It can be measured by the number of external environmental audits, extent to which these external audits' recommendations are followed and the existence of chemical risk assessment if applicable.

In turn, the aforementioned activities will have some bearing on the actual environmental performance of the industrial facility, which, in this case will be measured by the BOD compliance rate measured as,

$$\frac{\text{Actual BOD} - \text{BOD standard}}{\text{BOD standard}} \times 100$$

Note that the value of the compliance rate will be negative if firms are compliant.

5.6 Analytical Procedure: Simultaneous Equation Model

Following from the conceptual framework in Figure 1, the general form of the estimating linear simultaneous equation model is given by:

$$\mathbf{Y} = \Gamma\mathbf{Z} + \mathbf{Y}\beta + \varepsilon$$

where:

Y is a m x1 vector of latent endogenous variables

Z is a n x 1 vector of latent exogenous variables

Γ is a m x n matrix of coefficients to be estimated

β is a m x n matrix of coefficeints to be estimated

ε is a m x 1 vector of residual errors

The EQS 6.1 (Build 88) software is used to estimate the above model.

A principal component analysis was first done to reduce the dimension of the relevant explanatory variables. This is a preparatory step towards the estimation of the simultaneous equation model of environmental performance. It is a useful tool considering the small sample size for the study.

In keeping with the standard rules, the factors were chosen using the following criteria: a) the eigenvalues were larger than unity, b) individually they contribute to more than 10% of the variance in the data, and c) the cumulative contribution of the factors account for more than 60% of the variation in the data. For the estimation in the next section however, only the first factors were used to avoid having too many variables in the simultaneous equations. Having too many variables and a small sample size can reduce the degrees of freedom of the estimation and thus, reduce the accuracy of the estimates. Furthermore, the factor loadings of each of the components of the factors were based on the rotated factor loadings obtained through the varimax method. The results of the PCA are shown in Appendix Tables 1-9.

The constructed indices obtained from the PCA were then used in the regression analysis.

6.0 RESULTS AND ANALYSIS

6.1 The Environmental User Fee System (EUFS)[2]

6.1.1 Why It Was Imposed

Laguna de Bay is considered as the largest inland body of water in the Philippines. The basin boundaries include 5 provinces (CALABARZON) and parts of Metro Manila. It serves as the main source of living for its over 13 million inhabitants. It is also a host to some 10,000 multi-scaled enterprises. Table 1 shows the number of industries in the Region as of 2002.

[2] This section draws heavily from discussion of the EUFS found in LLDA's website: www.llda.gov.ph

Table 1. Number of Industries in theLaguna de Bay Region, 2002.

Registered		2,309
Wet	599	
Dry	591	
Wet and Dry	890	
Unclassified	229	
Monitored and Unregistered *		1,464
TOTAL		3,773

Source: (Source LLDA-MIS, October 2002)
* Firms that were already inspected by LLDA, but have not yet engaged in any transactions with them.

As a result of the continuous increase in the number of enterprises being built within the Lake's Region, pollution has become inevitable. Figure 2 shows the pollution percentage share of the different sectors around the Laguna de Bay Region.

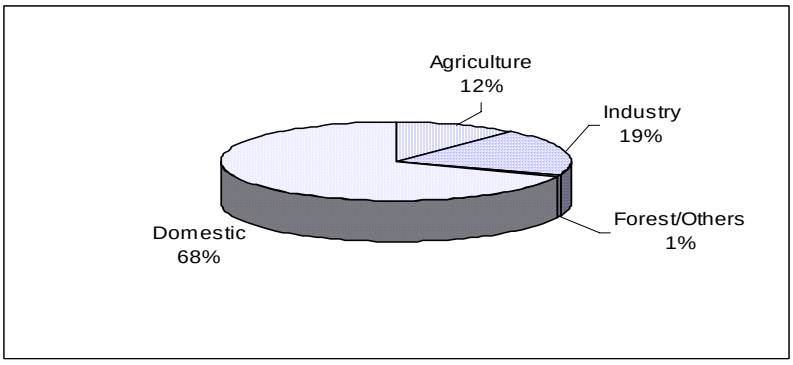

Figure 2. Sources of Pollution within the Laguna de Bay Region.
(Source: LLDA)

Laguna de Bay is presently being eyed as a possible source of domestic water supply for Metro Manila and nearby provinces. Therefore, there has been a need to protect and maintain the ecological integrity of the lake by reducing, if not completely eradicating, pollution. Thus, in January 1997, the Laguna Lake Development Authority launched the Environmental User Fee System (EUFS). The EUFS is a pioneer water pollution charge system in the Philippines. It has become an integral part of LLDA's Environmental Management Program and was included in the Laguna de Bay Master Plan, which emphasizes the use of economic incentives to address environmental problems and issues.

The EUFS is a market-based policy instrument in the form of a user fee implemented to complement the existing regulatory mechanisms of LLDA. Its main objective is to encourage companies to install and operate pollution prevention and/or abatement systems within their establishments. The system was based on the "Polluter Pays Principle". Here, the establishments are held responsible for any damage inflicted on the integrity of the Laguna Lake. As a result, individuals and business establishments

are encouraged to consider the environmental impacts of their activities into their decision-making process.

6.1.2 Who Are Covered?

In 1997, the EUFS was first applied to all industrial wastewater discharges along the leading industry sub-sectors with annual load of 4,000 kilograms BOD. In 1998 to 1999, the system's coverage expanded to include industries, subdivisions and commercial establishments as well as food chains and restaurants. Even firms which practiced zero discharge schemes were covered. Therefore, the 4,000 kg/yr BOD load cut-off has since been abolished (LLDA 2001).

At present, the EUFS now covers all enterprises within the administrative jurisdiction of LLDA that discharge wastewater in the Laguna de Bay system. These include commercial/industrial establishments; agro-based industries/ establishments (such as swine farms and slaughterhouses); clustered dwellings (i.e. residential subdivisions); as well as domestic households. Efforts toward the expansion of the EUFS to include households are underway.

6.1.3 What are the Charges?

Under this scheme LLDA charges industrial and commercial establishments in the Laguna de Bay catchment an annual user fee based on volume of discharge and BOD_5 load in the wastewater. Thus,

$$AF = FF + (VF * TBOD_5)$$

where:

AF = Total annual user fee (PHP)
FF = Fixed fee (PHP)
VF = Variable fee (PHP)

The formula for obtaining the total annual BOD_5 is:

$$TBOD_5 = C_{BOD5} * Q * d * Cf$$

where:

$TBOD_5$ = total annual BOD_5 in kg
C_{BOD5} = average effluent concentration of BOD_5 (mg/li)
Q = daily wastewater discharge (m^3/d)
d = number of discharging days per year
Cf = unit conversion factor (10^{-3})

The **fixed fee** covers the cost of the program administration and is dependent on the volumetric rate of discharge. Fixed fees are based on the number of wastewtaer sampling needed to monitor the firms' environmental performance. LLDA claims that the larger the firm in terms of volume of wastewater discharge, the more sampling will be needed and therefore higher fixed fees are imposed .

The **variable fee** is assessed based on the unit load of pollution which is computed as the product of the volumetric rate of discharge and the effluent concentration.

Table 2 shows the historical rates of the EUF. Since its implementation in 1997, the structure of the variable fee has remained the same: PHP 5.00 per kg BOD for compliant firms and PHP 30.00 per kg BOD in excess of the standard. The fixed fee, on the other hand, increased by 60% between 1997 and 2005 with the addition of a processing fee worth PHP 5,000.

Table 2. Changes in the Structure of the Environmental User Fee, 1997-2005

Legal Basis	Series	Date of Effectivity	Volume of Wastewater Discharge	Processing Fee (PHP)	Fixed Fee (PHP)	Variable Fee (PHP/kg BOD)	
						if complying (≤50 mg/li)	if not complying (>50 mg/li)
LLDA BR. 33	1996	Jan. 17, 1997					30/kg excess BOD
			≤30m^3/day	-	5,000	5/kg BOD	
			30-150 m^3/day	-	10,000	"	"
			> 150 m^3/day	-	15,000	"	"
LLDA BR. 176	2002	April 16, 2002	Conventional Parameters	-			30/kg excess BOD
			≤30m^3/day	-	6,800	5/kg BOD	
			30-150 m^3/day	-	12,000	"	"
			> 150 m^3/day	-	18,000	"	"
			w/ heavy metals	-			30/kg excess BOD
			≤150m^3/day	-	12,000	5/kg BOD	
			> 150 m^3/day	-	18,000	"	"
LLDA BR. 251	2005	Oct. 5, 2005	Conventional Parameters				30/kg excess BOD
			≤30m^3/day	5,000	8,000	5/kg BOD	
			30-150 m^3/day	5,000	16,000	"	"
			> 150 m^3/day	5,000	24,000		
			w/ heavy metals				30/kg excess BOD
			≤150m^3/day	5,000	16,000	5/kg BOD	
			> 150 m^3/day	5,000	24,000	"	"

Source: Various LLDA Board Resolutions

6.2 Survey Results

6.2.1 Profile of the 89 Sample Firms

Who Responded to the Survey?

The survey was intended for firm managers, supervisors and pollution control officers as they are in the best position to talk about their perceptions on the impact of the EUF on the environmental performance of their respective firms. They are also deemed to have the information and experience edge where the various sources of pressure affecting the firms' pollution abatement behavior are concerned. Of the 89 respondents to our survey, 58% occupied top management positions and 39% were pollution control officers who were generally also engineers and heads of the environment and safety department of the firms. Forty-five or 51% of firms were from Metro Manila, 35 or 37% were located in Laguna, and the rest were from Batangas, Cavite and Rizal.

Firm Classification by Industrial Sub-sector and Volume of Wastewater Discharge

Figure 3 shows that firms engaged in metal finishing, electronics, automotive and semiconductor industries topped the list of our sample respondents (35%).This is followed by companies in the chemicals, pharmeceuticals, plastics and laundry services industries (20%) and those involved in food and beverages sub-sector (18%). Other firms surveyed were the malls, hotels and restaurants. The rest were companies in the garments and textiles (8%), pulp and paper (3%) subsectors.

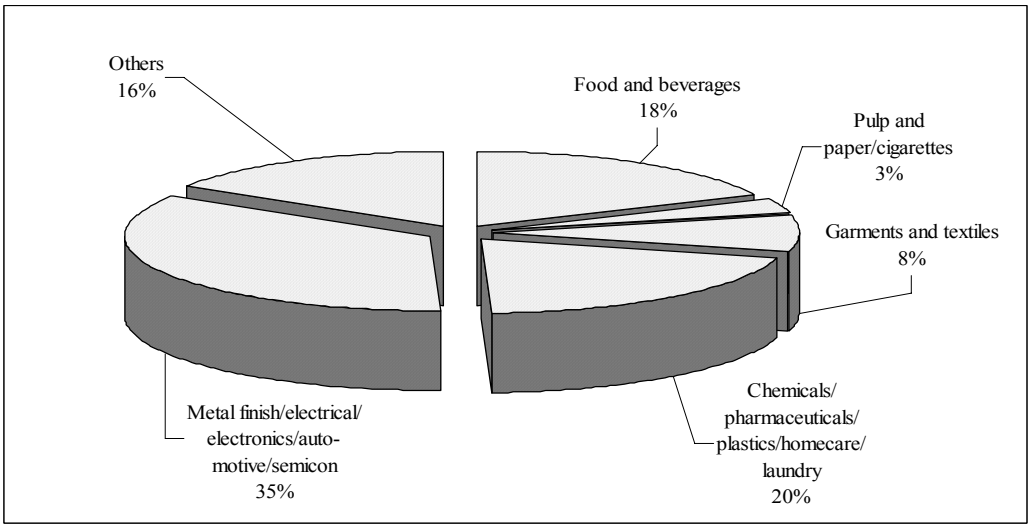

Figure 3. Distribution of 89 Sample Firms by Industrial Sub-sector, 2004.

Classification of sample firms by volume of daily wastewater discharge shows a slight dominance of small firms (<30 cu.m. per day) which comprised 40% and a more or less equal representation of medium (30 to 150 cu.m. per day) to large firms (>150 cu.m. per day) at 29% and 31%, respectively.

A further stratification of the sample by subsector reveals that except in the pulp and paper, chemical/pharmaceutical and the "others" sector, firms in general have reduced their volume of wastewater between 1999 and 2004. Thus, we see relative dominance of the small and medium-sized firms by 2004 (Table 3).

Table 3. Percent Distribution of 89 Sample Firms by Volume of Wastewater and by Sub-sector, 1999 and 2004

	1999			2004		
Sub-sector	<30 m3/day	30-150 m3/day	>150 m3/day	<30 m3/day	30-150 m3/day	>150 m3/day
Food & Beverage (n=16)	19	13	69	25	19	56
Pulp & Paper (n=3)			100			100
Garments & Textile (n=7)		71	29	29	43	29
Chemical/Pharma (n=18)	44	44	11	50	33	17
Metal finish/electronic (n=32)	53	22	25	56	31	13
Others (n=13)	23	31	46	15	31	54

6.2.2 Impacts of the EUFS

Having been regulated by LLDA for six years from 1999 to 2004, the 89 survey respondents are deemed to be in the best position to give their perceptions on how the imposition of the EUFS impact on their actions and behavior toward pollution abatement. The discussions that follow are divided into quantitative and qualitative impacts of the EUFS.

The quantitative impacts include six-year trends in average a) EUF paid; b) volume of wastewater discharge; c) BOD concentration measured in mg/li; d) BOD loading in kg per year; e) BOD compliance rate (%); f) changes in chemical use and g) nature of and capital investment in abatement technology . There are three levels of discussions and analysis: the aggregate sample then by industrial sub-sector and then by volume of wastewater disharge.

The qualitative impacts capture how firms perceive various sources of pressure for pollution abatement and then how these perceptions affect or influence their internal attittudes and actions related to the firms' enviromental performance.

Quantitative Impacts of the EUFS

EUF Paid by Firms

Over the period 1999-2004, there has been a decreasing trend in the average EUF paid by the 89 firms (Figure 4). However, from 2001 onward, the fixed fees paid by firms dominate the variable fee.

Across sub-sectors, the same declining trend in average EUF is seen, with the exception of the chemical/pharmaceutical and laundry sub-sector. The food & beverage sub-sector as well as the pulp and paper sub-sectors recorded the highest percent decrease in average EUF paid over the period (Table 3a). In 1999, among the sample,

the highest EUF was paid by a food & beverage firm amounting to PHP704,822. After six years of regulation, the maximum EUF paid by a firm in this same sector dropped by as low as 22 times.

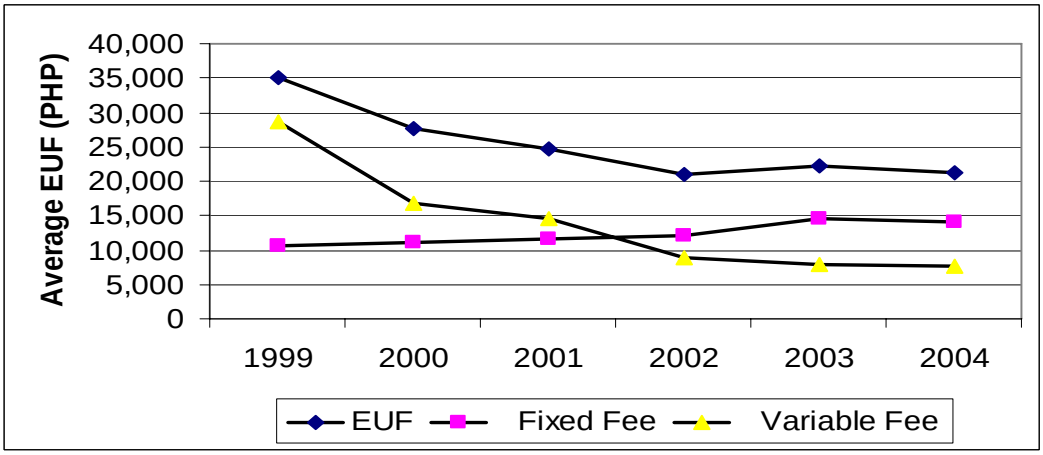

Figure 4. Average EUF Paid by 89 Firms, 1999-2004.

Table 4a. Average EUF Paid by 89 Sample Firms, by Sub-sector, 1999-2004

Sub-sector	Average EUF Paid ('000 PHP)					
	1999	2000	2001	2002	2003	2004
Food & Beverage	91.3	34.3	39.2	20.5	23.3	19.4
Pulp and Paper	110.6	259.6	65.3	42.5	54.2	44.4
Garments & Textile	24.7	13.6	31.6	21.2	15.6	17.2
Chemicals/Pharma	11.0	18.1	14.3	18.7	27.6	32.1
Metal finishing/Electronics	14.3	15.4	16.0	14.4	16.2	14.2
Others	25.7	28.5	31.0	36.6	23.6	24.4

Table 4b presents the distribution of firms according to the fixed fees paid from 1999 and 2004. On the other hand, Table 4c shows the average variable fees paid.Except for the chemicals/pharmaceuticals/laundry sub-sector, and all things equal, the declining trend in average variable fees also reflect decreasing BOD loadings since variable fees are based on the level of this pollutant.

Table 4b. Distribution of 89 Sample Firms by Fixed Fees Paid, by Sub-sector, 1999-2004

Legal Basis & Effectivity	Fixed Fee (Php)	1999	2000	2001	2002	2003	2004
	<30 m3/day						
BR 33, Jan 17, 1997	5,000	19	21	29	15		
BR 176, Apr 16, 2002	6,800				8	22	25
	8,000<fee<10,000				1		
	30-150 m3/day						
BR 33, Jan 17, 1997	10,000	17	27	17	11		
BR 176, Apr 16, 2002	12,000				11	24	22
	10,000<fee<14,000					2	1
	>150 m3/day						
BR 33, Jan 17, 1997	15,000	20	29	33	12		
BR 176, Apr 16, 2002	18,000				19	25	23
	>18000[a]				4	9	8
	Total[b]	56	77	79	80	83	79

[a] Firms had more than one outlet of wastewater for sampling
[b] May not equal 89 because of missing data

Table 4c. Average Variable Fees Paid by 89 Sample Firms, by Sub-sector, 1999-2004

	Average Variable Fee ('000 PHP)					
Sub-sector	1999	2000	2001	2002	2003	2004
Food & Beverage	87.4	22.2	29.6	7.4	7.7	5.1
Pulp and paper	95.6	244.6[3]	49.0	25.5	36.2	28.4
Garments & Textile	13.1	3.6	19.1	7.9	4.5	4.9
Chemicals /Pharma	3.4	8.6	6.0	8.6	13.1	17.7
Metal finishing/Electronics	6.0	4.9	6.8	3.0	3.0	2.6
Others	15.9	16.4	16.0	23.4	9.4	9.5

[3] LLDA data show that only two out of three firms surveyed in the pulp and paper sector paid variable fee for the year 2000. The variable fee here is the average of Php 431,432 and Php 57,704.

By size, Figure 5 shows that the average variable fee paid by medium and large firms did not change much over the span of 6 years. It is the small firms that appear to have had significant reductions in the variable fees paid.

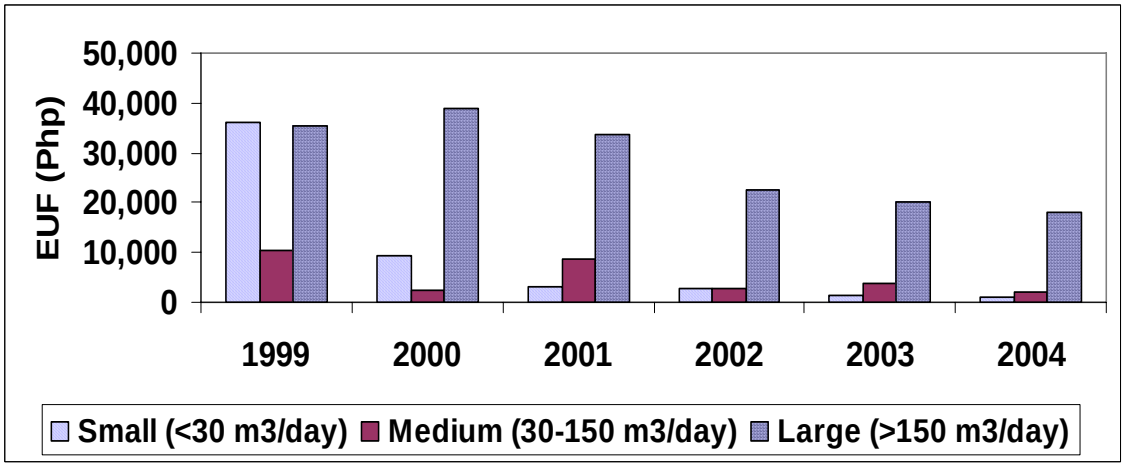

Figure 5. Average Variable Fee paid by 89 Sample Firms, by Volume of Wastewater Discharge, 1999-2004

Volume of Daily Wastewater Discharge

The 89 sample firms had an average wastewater discharge of 621 m^3 per day in 1999. This steadily decreased over the years to an average of 349 m^3 per day by 2004 (Figure 6). In fact, there are relatively more firms in 2004 that are classified as small (39%), discharging less than 30 cu.m of wastewater per day, compared to only 35% in 1999; subsequently, the proportion of large firms or those dicharging more than 150 cu.m of wastewater per day declined from 36% in 1999 to only 31% in 2004 (Table 5a).

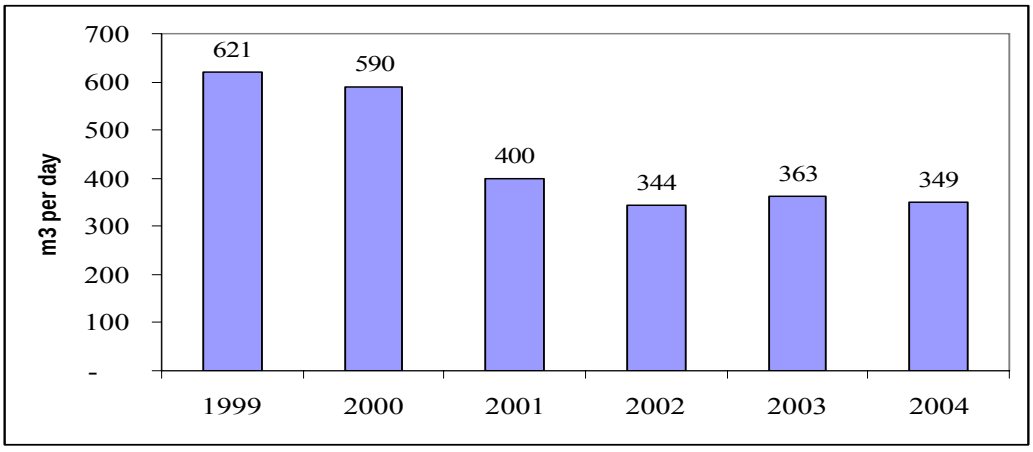

Figure 6. Average Daily Volume of Wastewater Discharge, 89 Sample Firms, 1999-2004

Table 5a. Distribution of 89 Sample Firms by Volume of Wastewater Discharge, 1999 and 2004

Category	1999		2004	
	No.	%	No.	%
Small (<30 m3/day)	31	35	35	39
Medium (30-150 m3/day)	26	29	26	29
Large (>150 m3/day)	32	36	28	31

Across sub-sectors, the sample firms, excluding those in the pulp and paper as well as the "others" sectors, clustered to an average of less than 500 m^3 per day by 2004. The pulp and paper sector whose production is quite water-dependent, posted an average of about 2,000 m^3 per day, albeit this is already a remarkable decrease from the starting average of 10,000 m^3 per day in 1999 (Table 5b).

Table 5b. Average Volume of Wastewater, 89 Sample Firms, by Sub-sector, 1999-2004

Sub-sector	1999	2000	2001	2002	2003	2004
Food & Beverage	459	457	336	334	392	309
Pulp & Paper	10,391	9,891	3,589	2,539	2,194	2,126
Garments & Textile	312	244	301	246	217	216
Chemical/Pharma	318	93	309	309	356	388
Metal finish/electronic	168	140	107	85	100	98
Others	267	588	643	586	643	626

BOD Concentration

Over the period 1999-2004, the 89 sample firms, on average, registered BOD concentrations that were less than the 50 mg/liter BOD standard and exhibited declining trend through the years (Figure 7a). A closer look into the proportion of firms that performed much better than the standard revealed that in 1999, 57% of them already posted BOD concentration at <10 mg/li, while 28% had BOD concentrations between 10-50 mg/li. A mere 16% were not able to meet the 50 mg/li standard. By 2004, these proportions improved to 68%, 27% and 5%, respectively (Figure 7b).

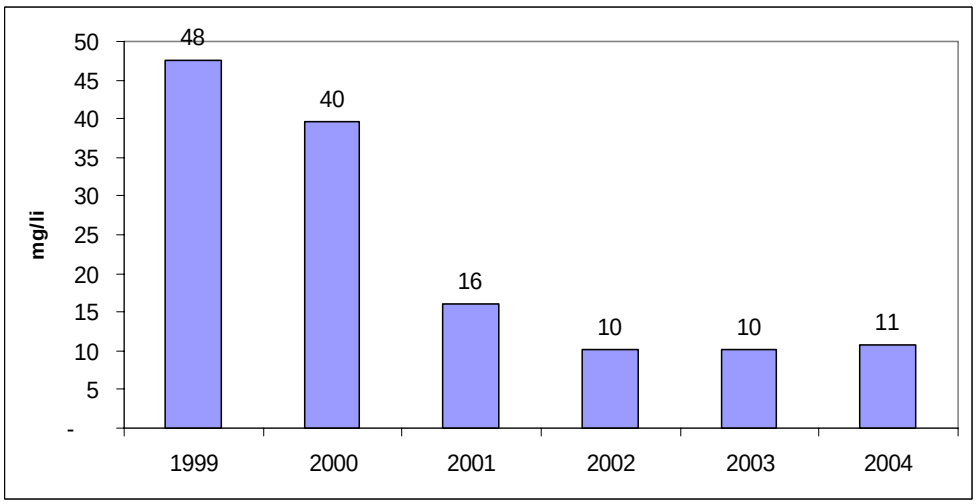

Figure 7a. Average BOD Concentration (mg/li) of 89 Sample Firms, 1999-2004

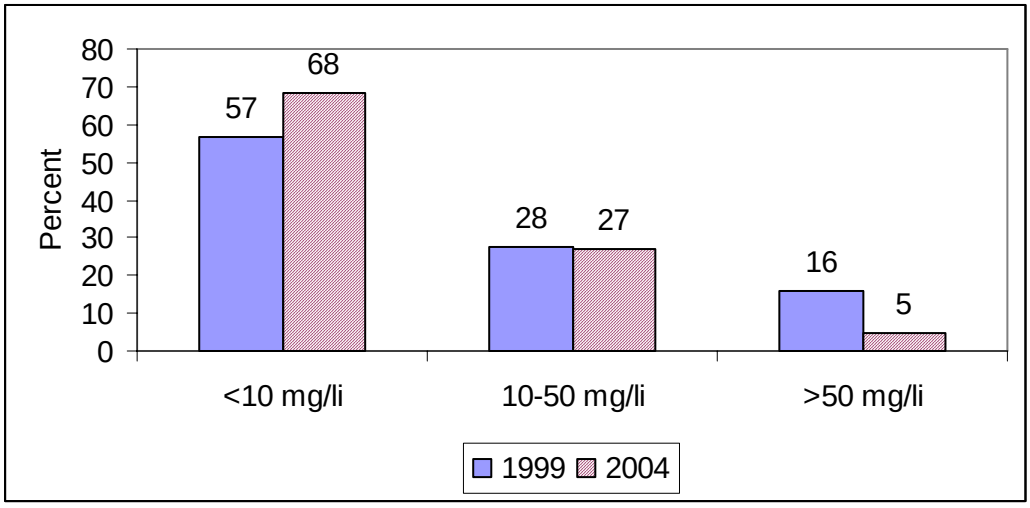

Figure 7b. Percent Distribution of 89 Sample Firms by BOD Concentration (mg/li), 1999 and 2004

Sub-sectorwise, we see in Table 6 that the Metal finishing and electronics sector actually registered increasing trend in average BOD concentration, notably starting in 2002. But this distorted trend is caused by extremely high concentrations from only 2 or 3 firms[4]; hence the average is pulled up. Otherwise, at least about 80% of firms in this sub-sector actually have BOD concentrations of less than 10 mg/li from 2002-2004. The Pulp and paper sector, a heavy user of water and chemicals, showed steady concentration rates that were within the 50 mg/liter BOD standard.

[4] This warrants a more careful examination of LLDA dataset.

Table 6. Average BOD Concentration of 89 Firms, by Sub-sector, 1999-2004

Sub-sector	*Average BOD Concentration (mg/li)*					
	1999	*2000*	*2001*	*2002*	*2003*	*2004*
Food & Beverage	120	101	16	13	12	12
Pulp and Paper	25	20	34	12	24	14
Garments & Textile	60	40	32	30	33	11
Chemicals/Pharma	14	19	18	12	10	15
Metal finishing/electronics	30	27	12	4	3	8
Others	43	24	11	7	8	8

BOD Loading[5]

Average annual BOD loading of sample firms also declined over time. From an average high of about 10,000 kgs BOD, this went to down to about 1,000 in 2004. (Figure 8). By sub-sector, despite downtrend, we see the Pulp and Paper sector having BOD loadings that are more than 10 times the average of the other sectors (Table 7).

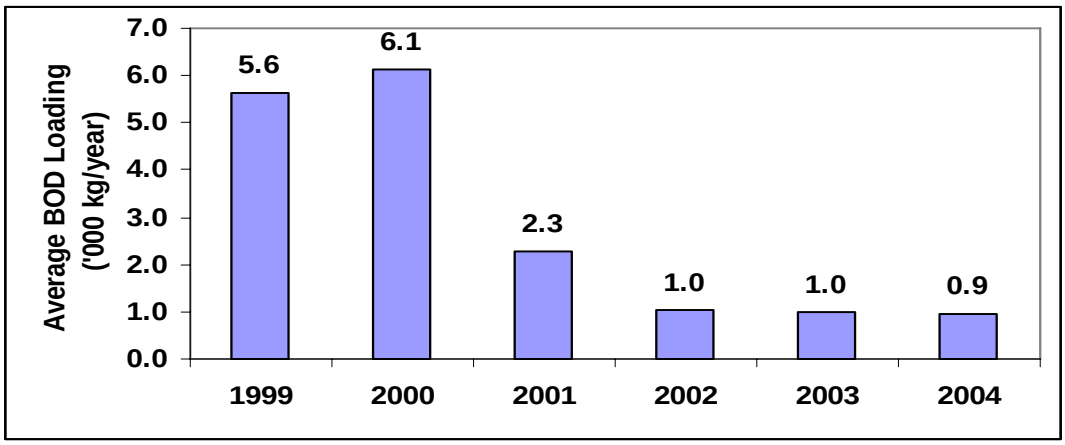

Figure 8. Average BOD Loading (kg/year) of 89 Firms, 1999-2004

[5] From LLDA datasets

Table 7. Average BOD Loading of 89 Firms, by Sub-sector, 1999-2004

Sub-sector	BOD Loading ('000 kgs/year) 1999	2000	2001	2002	2003	2004
Food & Beverage	1.9	7.4	1.1	0.9	1.0	0.8
Pulp & Paper	136.5	101.8	25.8	8.1	8.2	6.4
Garments & Textile	1.5	2.7	2.4	0.6	0.7	0.9
Chemical/Pharma	0.8	0.3	0.4	1.5	1.3	1.0
Metal finishing/electronics	0.6	0.9	0.6	0.1	0.2	0.3
Others	1.5	5.2	4.9	1.5	1.2	1.4

BOD Compliance Rate

Defining Compliance Rate as:

$$\frac{[\text{Actual BOD} - \text{BOD Standard}]}{\text{BOD Standard}} \times 100$$

this implies that a negative value means the firm is compliant and performs better than the standard. Figure 9 shows increasing compliance by firms over time. It is worthy to note that by 2004, firms' BOD levels, on average, were 80% better than the standard, e.g., if the BOD standard is 50 mg/li, the sample firms' actual BOD level, on average, was down to 10 mg/li.

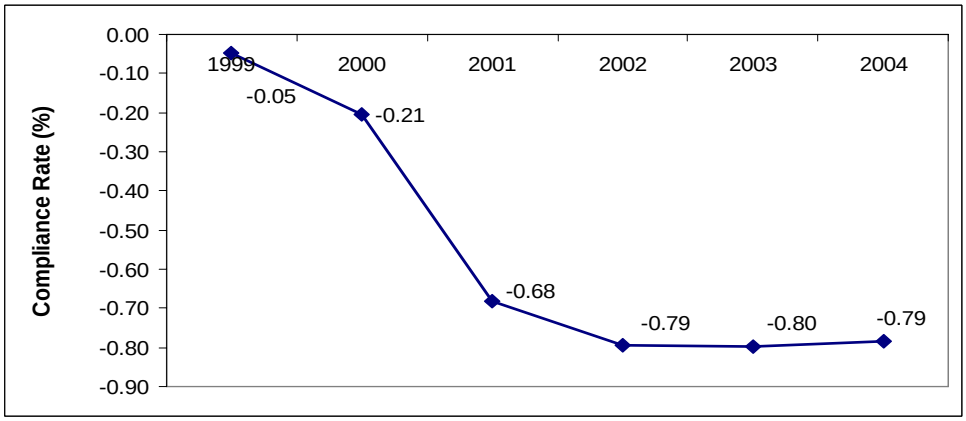

Figure 9. Average BOD Compliance Rate by 89 Sample Firms, 1999-2004

The same remarkable trend in compliance rate can be seen across all sub-sectors with the Metal finishing and electronics sub-sector registering the highest compliance rate by 2004. On the other hand, the Food and Beverage sub-sector made a good turnaround from being non-compliant in 1999 to highly compliant by 2004 (Table 8a).

In Table 8b, we see the proportion of compliant firms across sub-sectors over time. Except for the Garments & Textile as well as the Metal finishing/Electronics sub-sectors, all firms in the other subsectors were all meeting the standards by 2004.

Table 8a. Average BOD Compliance Rate by 89 Sample Firms, by Sub-sector, 1999-2004

Sub-sector	*Average BOD Compliance Rate (%)*					
	1999	2000	2001	2002	2003	*2004*
Food & Beverage	1.25	1.02	-0.71	-0.75	-0.78	*-0.78*
Pulp and Paper	-0.50	-0.60	-0.32	-0.76	-0.53	*-0.72*
Garments & Textile	0.20	-0.21	-0.37	-0.40	-0.35	*-0.78*
Chemicals/Pharma	-0.75	-0.64	-0.69	-0.78	-0.84	*-0.71*
Metal finishing/electronics	-0.39	-0.50	-0.79	-0.92	-0.94	*-0.85*
Others	*-0.30*	*-0.54*	*-0.78*	*-0.86*	*-0.83*	*-0.82*

Table 8b Distribution of 89 Sample Firms by Compliance to BOD Standard, by Sub-sector, 1999-2004

Sub-sector	Compliant Firms (%)					
	1999	2000	2001	2002	2003	2004
Food & Beverage	80	81	93	94	100	100
Pulp & Paper	67	100	67	100	67	100
Garments & Textile	71	71	71	71	71	71
Chemical/Pharma	94	100	93	100	94	100
Metal finishing/electronics	80	87	93	100	100	97
Others	92	92	100	100	100	100

Changes in Chemical Use

To be certain, these companies engaged in various technological methods and procedures to be able to attain the effluent standards. One of the adjustments made in response to the EUF was to adopt changes in the use of chemicals in their various operations. The more common change enacted was the reduction in at least one of the more environment-damaging chemical and Figure 10 shows that this was done by the majority of the respondents (44%). The two other changes in chemical use were to employ more environment-friendly chemicals as replacements (22%) or eliminate the use of harmful chemicals altogether (19%). Some of the other firms didn't have to make the change since they were not using harmful chemicals at all.

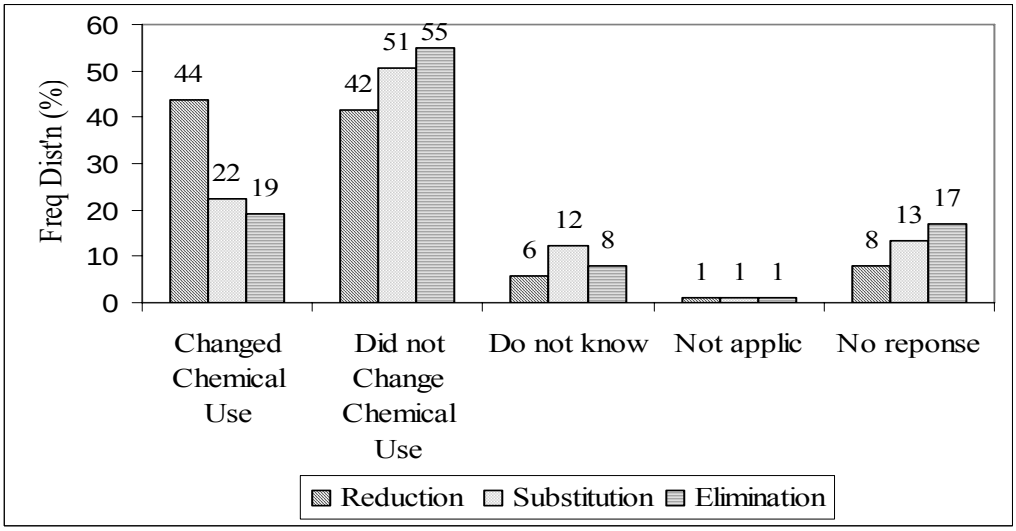

Figure 10. Changes in Chemical Use in Response to the EUF, 89 Firms, 2004

Waste Management Systems and Wastewater Treatment Facilities

Aside from changes in the use of chemicals, the more obvious manifestation of the impact of the EUF is the existence of waste management systems (WMS) and installation of wastewater treatment facilities (WWTF). Waste management system includes all activities, strategies and periodic trainings of firm's manpower that eventually lead to waste minimization, reduction, recycling and reuse. New methods of WMS involve the reduction, substitution and elimination of environmentally harmful chemicals. Wastewater treatment facilities refer to the physical equipment or plant that can have either primary and/or secondary treatment components[6].

Survey data show that 75% of sample firms have waste management systems. Thiry-three percent (33%) of these fims had their WMS existing even before the EUFS was implemented (see Table 12).

Primary wastewater treatment facilities have been installed by 70 firms or about 80% of the sample. One third of these 70 firms have put up their primary treatment plants even before the imposition of the EUFS. Half of the firms, though, installed the facilities after the EUFS imposition. The more common type of primary abatement technology consisted of physical or a combination with chemical treatment facility. For the physical treatment system, majority of the firms made use of combination of methods on the list. For chemical treatment plant, most firms employed PH adjustment and also a combination of the other methods.

On the other hand, 57 out of the 89 sample firms (64%) installed secondary treatment systems. It is interesting to note that half of these 57 firms had put up the facilities before the EUFS was implemented. The activated sludge was the common type of secondary treatment system used.

[6] Personal communication with waste management expert.

Table 9a. Distribution of 89 Sample Firms by Abatement Technology (PrimaryTreatment System)

ITEM	No.	%
1.1 Has primary treatment system (PTS) (n=89)	70	79
1.2 Period when PTS was installed (n=70)		
Before EUFS (1997)	24	34
After EUFS (1997)	34	49
Do not know	12	17
1.3 Type of Primary Treatment System (n=70)		
Physical treatment system only	28	40
Chemical treatment system only	7	10
Both treatment system	35	50
1.4 Composition of Physical Treatment System (n=70)		
Screening	10	14
Equalization	12	17
Grit removal	2	3
Oil-water separator	5	7
Sedimentation	5	7
Two or more of the above	33	47
Do not know	3	3
1.5 Composition of Chemical Treatment System (n=70)		
Adsorption	1	2
Disinfection	5	8
Flocculation	7	11
PH Adjustment	21	33
Others	4	6
Two or more of the above	26	41

Table 9b. Distribution of 89 Sample Firms by Abatement Technology (Secondary Treatment System)

ITEM	No.	%
1.1 Has secondary treatment system (STS) (n=89)	57	64
1.2 Period when STS was installed (n=57)		
Before EUFS (1997)	30	53
After EUFS (1997)	20	35
Do not know	7	12
1.3 Type of Secondary Treatment System (n=57)		
Activated sludge	26	46
Anaerobic & aerobic treatment	7	12
Aerobic treatment	2	4
Oxidation/stabilizer	5	9
Rotating biological contractors	2	4
Trickling filter	3	5
Two or more of the above	10	18
Do not know	2	2

Investments in wastewater treatment facilities are alleged to have been extremely costly for the firms, ranging between PHP25 thousand to PHP60 million with an average of PHP8 million. The greater majority of the firms spent at least PHP 2 million for treatment systems. However, abatement facilities of most firms are relatively old, having been put up at least 10 years ago (Table 9c). Table 9d presents the information on abatement technology investment cost across sub-sectors[7].

[7] The analysis is limited by the incomplete information provided by firms on the nature, characteristics and cost of abatement technology investment as these were not the focus of the study. Future researches may give this area more focus to come up with a more detailed and robust analysis.

Table 9c. Distribution of 89 Sample Firms by Age and Investment Cost of Abatement Technology

Age of Abatement Technology	No.	%
<10 years	18	38
10-20 years	17	36
>20 years	12	26
Investment Cost (PHP)	**No.**	**%**
<30,000	1	2
30,000-100,000	1	2
0.1M-0.5M	9	14
0.5M-0.9M	5	8
1M-2M	8	12
>2M	41	63
total	65	100
Min	25 T	
Max	60 M	
Average	8 M	

Table 9d. Average Investment Cost of Abatement Technology, by Age and Type of Technology and by Sub-sector, 89 Sample Firms

Sub-sector*	Average Investment Cost (million PHP)			
	<10 years		>=10 years	
	Activated sludge	Others	Activated sludge	Others
Food & Beverage	15.9	3.0	4.0	29.3
Garments & Textile	-	-	15.0	4.5
Chemicals & Pharma	-	-	3.8	7.2
Metal Finishing & Electronics	3.5	9.9	13.2	9.9
Others	8.2	6.0	2.9	-

* Insufficient data for Pulp and Paper sub-sector.

In general, firms have installed relatively high cost technology since there are comparable wastewater treatment facilities that are currently being used by other firms

in similar industries whose costs are, on average, at least twice as cheap than what the surveyed firms have invested[8].

It is evident that about 50% of the firms have earmarked less than two percent of their annual income for pollution abatement expenditures.

Surveyed firms, in general, are complaining about the high cost or financial burden of investing in wastewater treatment plants. Technically, however, they also have the option of simply keeping their pollution levels more or less the same over time and then pay the wastewater fees instead. Thus, in the interest of comparing these two options, the pollution fees that the enterprises would have paid had they not reduced their pollution between 1999 and 2004 were estimated and then compared to their investment cost on abatement technology. Tables 10a and 10b show this information in nominal and real terms. Barring huge transaction costs and other potential/hidden fees that have not been accounted for, it appears that firms would be financially better off by paying the pollution fees instead of installing wastewater treatment facilities. Nevertheless, it is conjectured that firms could possibly have more overriding concerns and motivations for investing in pollution abatement technologies.

Table 10a. Estimated Pollution Fees (in nominal terms, PHP M) if Sample Firms Did Not Install Treatment Facilities, by Sub-sector

Sub-sector	1999	2000	2001	2002	2003	2004	1999-2004
Food & Beverage	0.41	0.41	0.41	0.41	0.41	0.41	2.45
Pulp & Paper	1.69	1.69	1.69	1.69	1.69	1.69	10.15
Garments & Textile	0.40	0.40	0.40	0.40	0.40	0.40	2.42
Chemical & Pharma	0.38	0.38	0.38	0.38	0.38	0.38	2.27
Metal Finishing & Electronics	0.38	0.38	0.38	0.38	0.38	0.38	2.28
Others	0.39	0.39	0.39	0.39	0.39	0.39	2.35
All Firms	0.43	0.43	0.43	0.43	0.43	0.43	2.59

[8] These estimates were obtained from expert opinion and are based on the cost of waste treatment facilities currently in use by other firms in similar industries. The technical coefficients are as follow: a) The investment cost for aerobic treatment w/o mechanical aerators and unclassified anaerobic treatment is PHP 61 - 121 per liter; b) The investment cost for oxidation, aerobic treatment w/ mechanical aerators, aerobic treatment w/ mechanical aerators + anaerobic treatment is PHP 15 - 91 PHP per liter; c) The investment cost for activated sludge, trickling filters and rotating biological contactor is PHP 90-320 per liter.

Table 10b. Estimated Pollution Fees (in real terms, PHP M) if ***Sample*** Firms Did Not Install Treatment Facilities, by Sub-sector

Sub-sector	1999	2000	2001	2002	2003	2004	1999-2004
Food & Beverage	0.41	0.37	0.34	0.31	0.28	0.25	1.95
Pulp & Paper	1.69	1.54	1.40	1.27	1.16	1.05	8.10
Garments & Textile	0.40	0.37	0.33	0.30	0.28	0.25	1.93
Chemical & Pharma	0.38	0.34	0.31	0.28	0.26	0.24	1.81
Metal Finishing & Electronics	0.38	0.34	0.31	0.29	0.26	0.24	1.82
Others	0.39	0.35	0.32	0.30	0.27	0.24	1.87
All Firms	0.43	0.39	0.36	0.33	0.30	0.27	2.07

Qualitative Impacts of the EUFS

Sources of Pressure for Pollution Abatement as Perceived by Firms

The main objective of this study is to look into the determinants of the enviornmental behavior of firms and facilities. What are the sources of pressure faced by the firm that affect their decisions to improve their environmental performance? Is the EUF still a source of pressure for regulated firms? Or are there other pressure factors that work in complement with the EUF or overrides the impact of the EUF altogether?

Table 11 shows that firm managers and pollution control officers perceive governments in general (cited by 68 or 79% of respondents) to be the main source of pressure and this is consistent with the findings of Doonan et al (2002). Regulations such as the EUF are tools used by governments and therefore would fall within this pressure category .There is also pressure from customers although they are not a major source as in the findings of Henriques and Sadorsky (1995). Clients of firms are actually the 2nd important source of pressure (cited by 19 or 21% of respondents). Pressure from the community and environmental groups is perceived as 3rd important source of pressure. Similar to the results of Doonan et al (2002) but unlike those of Lanoie et al (1998); Konar and Cohen (2001) (cited by Doonan et al 2002), creditors, financial intermediaries and investors were not perceived as significant sources of pressure.

Table 11. Sources of Pressure as Perceived by 89 Firm Managers, 2004

Sources	1st source	2nd source	3rd source	1st Source Increased Most in the Past 5 Years
Governments in general	**68**	0	0	39
Customers	6	**19**	6	3
Public/community pressure	0	5	**14**	2
Environmental groups	0	0	**15**	2
Employees	1	4	2	0
Investors/bankers/shareholders	1	2	1	3
Suppliers	1	1	1	1
Competitors	0	1	3	0
Others	0	1	12	1
No response	2	8	7	15

Changes in Firms' Internal Attitudes and Actions

As discussed in the framework shown in Figure 1, the way that environmental managers and supervisors view the various sources of pressure will then affect their decisions on what courses of action to pursue in relation to improving environmental performance. The following sections will now discuss these sets of action.

The existence of an integrated environmental management system (EMS) or an environmental management plan (EMP) is the more common indicator of **integration** activities particulalry in developed countries (Doonan et al 2002; Henriques and Sadorsky 1995). However, this study suggests that the presence of a waste management system (WMS) is the more appropriate indicator to use insofar as the environmental regulatory measures in the country focus on effluent standards: Biological Oxygen Demand (BOD) and Total Suspended Solids (TSS).

It can be seen from Table 12 that the greater majority of the sample firms have WMS. About one-fifth of them are already ISO 14000 registered while one-third intend to become registered. There is a joint employer-employee committee on the environment in more than half of the companies.

Table 12. Integration of Environmental Issues by 89 Sample Firms, 2004

	Responses (%)							
	Yes		No		Do not know		N/R	
Existence of a waste mgt system	75		20		3		1	
Intention to obtain ISO 14000 certification	30		29		18		4	
Already ISO 14000 registered	18							
Existence of a joint committee on env't	57		33		4		6	
Contact of environmental services with	Formal & Frequent	Formal & occasional	Informal	Rare	Non-existent	Do not know	N/A	N/R
top management	51	34	8	1	4	1	0	1
engineering	52	26	11	3	7	0	0	1
production	52	21	13	3	6	0	2	2
research and development	22	19	11	9	29	1	4	3
Active participation of employees in the dev't of the environmental policy	Agree totally	Agree somewhat	Somewhat disagree	Totally disagree	Do not know	N/A	N/R	
	46	29	12	4	1	3	3	

N/A – not applicable; N/R- no response

It is worth noting that for at least half of the sample firms, there are formal and frequent consultations between environmental services and top management, engineering and production. Environmental policy development is also participated in actively and jointly by management and employees. However, very little contact is made between environmental services and research and development.

In terms of investing in **human resources** by providing trainings related to the environment, not all of senior management nor all of the employees are given the opportunity (Table 13). It goes without saying that these training activities whether conducted in-house or elsewhere entail costs that firms are not always ready to shell out due to financial constraints. The pollution control officers are the sure recipients of these training activties since LLDA, for one, requires their participation in the annual programs conducted by the regulatory agency.

Most firms consider environmental issues in the performance evaluation of their emplpoyees but only one quarter of the firms actually consider environmental concerns in the compensation package.

Table 13. Human Resources, 89 Sample Firms, 2004

Categories of employees who have received an environmental training:	Responses (%)					
	All	Some	None	Do not know	N/A	N/R
Production employees	28	53	15	2	0	2
Supervisors	34	45	16	0	1	4
New employees	29	29	36	0	1	4
Administrative employees	25	42	29	0	0	4
Technical specialists	28	56	11	0	1	3
Senior managers	28	46	20	0	1	4
	Responses (%)					
Environmental issues is considered in:	Agree totally	Agree somewhat	Somewhat disagree	Totally disagree	Do not know	N/R
Compensation package	22	39	12	19	0	7
Workers' performance Evaluation	48	38	6	3	1	3

N/A – not applicable; N/R- no response

Table 14 shows the **financial resources** indicator as proxied by various indicators. The table reveals that primary and secondary wastewater treatment facilities for 33% and 26% of the sample firms, respectively, were already in place even before the establishment of the EUFS. Thus, it can be said that the concern for the environment has already been a part of the operation of these firms due to a variety of reasons like the implementation of the pollution control law, the mother company (usually foreign owned) requires it or the firm itself is proactive and believes in environmental proetction.

The budget and personnel alloted for environmental issues generally remained the same in the last five years . Some firms managed to increase them.

Table 14. Financial Resources, 89 Sample Firms, 2004

Number of years since the installation of:	Responses (%)			
	1-5 years	6-10 years	> 10 years	Do not know/ N/R
Primary effluent treatment System	2	29	33	35
Secondary effluent treatment System	3	25	26	46
	Responses (%)			
Resources devoted to the Environment	Reduced	Maintained	Increased	Do not know/ N/R
Personnel	9	3	16	45
Budget	6	21	26	47

N/A – not applicable; N/R- no response

Monitoring system and activities (Table 15) have been proxied by indicators pertaining to external audits, following of recommendation of auditing institutions and chemical risk assessment. Three quarters of the firms have been doing external waste audits and performing chemical risk assessment in the last five years. Two-thirds of the firms often follow the recommendations made by external audit agencies.

Monitoring activities are common for the sample firms since they are required by LLDA to submit quarterly self-monitoring reports (SMRs).

Table 15 . Monitoring activities by 89 Sample Firms, 2004

Monitoring Activity	Responses (%)			
	Yes	No	Do not know	N/R N/A
External auditing done during the last five years	72	22	2	3
Chemical risk assessment during the last five years	76	15	4	5
	Always	Often	Rarely	N/R
Recommendation from audits are followed	36	28	7	29

Environmental performance in this paper was proxied by indicators such as the BOD compliance rate as well as the existence of fines and receipt of notices of violations in the last five years from 2004.

More than 52% of the sample firms, though, received notices of violations in the last five years and 57% of them had to pay fines for the same period. Almost all of the firms experienced no spills of wastewater (Table 16).

Table 16. Environmental Performance of 89 Sample Firms, 2004

	Responses (%)			
Item	Yes	No	Do not know	N/R
Had to pay fine during the last five years	53	43	1	3
Had Spills (during the last year)	3	92	1	3
Non-compliance with regulations				
Received Notice of Violation in the past 5 years	48	46	3	2
Received Cease and Desist Order in the past 5 years	6	89	2	3

N/R - no response

Perceptions on Advantages and Disadvantages of the EUFS

When asked about the main advantage of the EUF imposition to the firm, most firms perceive the EUFS as being advantageous in forcing them to enhance their environmental consciousness and control waste and pollution. However, the majority of the respondents also lament the fact that complying with the EUFS meant heavy financial burden that made firms less competitive.

Four out of 10 respondents refused to give any comment[9] while 8 percent were bold enough to say that the EUF did not bring any advantage to the firm whatsoever (Table 17).

However, the remaining half of the sample had the common perception that the EUF has raised the environmental consciousness of the firms and forced them to control waste and pollution to comply with standards. The main motivation, therefore, that drives these firms to engage in environmental protection was to meet the effluent standards and avoid paying penalties that were perceived as exhorbitant. Cost saving also meant mitigating damages to the firm that can result from being labeled as non-compliant to regulations. Hence, firms were also motivated to meet standards to protect their public image and reputation.

Table 17. Main Advantages of the EUF as Perceived by 89 Firms, 2004

Main Advantage of EUF	%
Control waste & pollution/encourage envt'l consciousness	29
Compliance to envt'l standards	10
Cost-saving	4
Others	8
No advantage	8
No response	40

A major setback as perceived by firms with respect to the imposition of the EUF, however, are the very expensive investment and operating costs of wastewater treatment facilities (Table 18). These extremely high expenditures eat up on their profit and more imprtantly, make them unnecessairly less competitive particularly against firms that are outside the LLDA jurisdiction. A common sentiment voiced out by the respondents is that there should be equal implementation of the environmental standards across all firms in the country.

[9] But given the nature of Filipinos to typically withhold negative comments or criticisms, we take this 'no comment' or 'no response' behavior of respondents to be implying the exact opposite—that they have indeed many things to say but were hesitant to say it or worse, write it for fear of being implicated. True enough, such behavior was validated when firms turned out to be more vocal during the dissemination of results seminar.

Furthermore, there is the all-important perception that LLDA should give proper incentives to firms that perform much better than the standard since marginal abatement cost was also very high..

Another useful insight that was raised was that the regulating agency has the responsibility of not only monitoring compliance but disseminating information on cost effective and efficient pollution abatement technology. Many firms end up incurring very high opportunity costs of having invested in the wrong technology simply because they don't have access to information on which appropriate technology will enable their firms to comply with the standards and at the same time one that would not be as costly.

Table 18. Main Disadvantages of the EUF as Perceived by 89 Firms, 2004

Main Disadvantage of EUF	%
Very costly/expensive treatment facilities/less competitive	38
Difficult to attain standards/no technical support	2
Unequal implementation of EUFS; bribes and negotiations	8
No disadvantage	11
No response	40

6.3 Sample Selection and Survey Non-Response

To reiterate from Section 4.3 on sampling procedure, the original 270 firms were not all interviewed for the following reasons: 72 firms were not stand-alone industrial facilities, 21 closed down, and 88 refused to participate in the survey. Thus, there were only a total of 89 firms that were personally interviewed. Nevertheless, firms that did not participate in the survey had pollution data available from their SMRs.

A possible problem with non-response is that it could have been a systematic rather than a random attrition. That is, the non-surveyed firms could have been more reluctant to be interviewed because they could have had very high BOD Loadings and EUFs than the 89 surveyed firms and were, therefore, not very compliant . In other words, there could have been, unknowingly, a sample selection that could lead to a downward bias in the estimates.

To test for sample selection bias, simple t-tests of means on pollution data of surveyed and non-responsive firms were done. Tables 19a to 19eshow the mean BOD Loading, Volume of Wastewater Discharge, EUF Paid, BOD Concentration and BOD Compliance Rate between the surveyed and non-surveyed (or non-responsive) firms.

Table 19a. Mean BOD Loading for Surveyed and Non-Surveyed Firms

Group	Obs	Mean	Std. Err.
Non-Survey	88	2695.96	791.47
Survey	89	2829.88	1482.04
combined	177	2763.30	840.35
diff		-133.91 (-0.08)	1685.49

*- t statistics in parenthesis

Table 19b. Mean Volume of Wastewater Discharge for Surveyed and Non-Surveyed Firms

Group	Obs	Mean	Std. Err.
Non-Survey	88	265.02	45.05
Survey	89	444.49	126.28
combined	177	355.27	67.48
diff		-179.47 (-1.33)	134.67

*- t statistics in parenthesis

Table 19c. Mean EUF for Surveyed and Non-Surveyed Firms

Group	Obs	Mean	Std. Err.
Non-Survey	88	30776.21	3395.37
Survey	89	25855.50	3164.69
combined	177	28273.68	2319.14
diff		4920.71 (1.06)	4637.28

*- t statistics in parenthesis

Table 19d. Mean BOD Concentration for Surveyed and Non-Surveyed Firms

Group	Obs	Mean	Std. Err.
Non-Survey	88	29.37	9.24
Survey	89	17.73	2.03
combined	177	23.51	4.71
diff		11.64 (1.24)	9.41

*- t statistics in parenthesis

Table 19e. Mean Compliance Rate for Surveyed and Non-Surveyed Firms

Group	Obs	Mean	Std. Err.
Non-Survey	88	-0.10	0.26
Survey	89	-0.55	0.08
combined	177	-0.33	0.14
diff		0.45 (1.62)	0.28

*- t statistics in parenthesis

The results of the simple two tailed T-tests above reject, at a 1% level of confidence, the alternative hypothesis that there are differences between the group means. These results hold for all the environmental performance indicators such as the BOD loading, BOD Concentration, Volume of Wastewater Discharge, Compliance Rate, and the EUF. This implies that, after controlling for the presence of outliers, there are no significant differences, on average, in the aforementioned variables between the two groups of surveyed and non-surveyed firms. Thus, the problem of sample selection bias might not be evident in the data.

Appendix Figures 1a to 1e show comparative pictures of the environmental performance indicators of the 89 sample (surveyed) firms and the 88 non-surveyed firms for the period 1999-2004. The non-significant difference in the means of the variables between the two groups can readily be seen as the respective averages tend to converge over time.

6.4 Simultaneous Equation Model (EQS) Results and Analysis

The survey data from the 89 firms were further analyzed using statistical techniques. In particular a simultaneous equation model was run to answer two important questions: (1) What factors statistically determine or affect compliance rate? and; (2) Once the compliance rate is known, what actions do firms undertake to improve or maintain compliance?

Results of the statistical analysis in Table 20 identified the following factors as determinants of compliance rate: (a) Investments in treatment facilities, (b) Monitoring activities, (c) Integration of environmental department with other units within the firm, (d) Environmental training of human resources, and (e) Involvement of top management in environmental affairs of the company. We now discuss the specific effects of these identified variables on the compliance rate of firms.

1. ***Investment in Treatment Facilities***. Results showed that investment in treatment facilities tend to decrease compliance rate of firms. This relationship, although counterintuitive, implies mainly the trial and error approach in searching for the appropriate abatement technology. Thus, it seems to point to technological constraints and that the lack of information on appropriate technology hinders compliance.

The feedback effect of compliance rate on investments, however, is in the opposite direction. That is decreased compliance rate tend to induce increases in treatment facilities investments. Tracing out the series of feedback between compliance rate and investments leads to the following pattern:

Low compliance rate → Increased investment → Lowers compliance further → Further increase in investments

This process shows that firms are locked into increasing investments on ineffective technologies in order to comply with standards. This does not mean, though, that firms do not comply or intends not to comply with rules, but rather firms comply in an inefficient and costly way. One clear policy implication is that informing firms of alternative and appropriate technology could lead to efficient compliance to standards.

2. ***Monitoring.*** The analysis revealed that monitoring increases compliance rate. However, feedback effects of compliance rate on monitoring (i.e. the effect of observed compliance rate on the level of monitoring) run in the opposite direction. This means that increased compliance leads to decreased monitoring. This traces the following relationships:

Low compliance rate → Increased monitoring → Increased compliance → Decreased monitoring

This shows that monitoring activity firms is more reactive rather than proactive. Thus, we can see or expect cycles of compliance and non-compliance among firms.

3. ***Integration of environmental department with other units within the firm.*** Although inconclusive, integration tends to decrease compliance rate. We believe that this result is mainly driven by nature of the data. At least 50% of the surveyed firms did not respond or did not know how to answer the survey question properly. Future work would require reframing the question to help the respondents answer clearly, correctly, and truthfully. This result is admittedly a gray area of the analysis.

4. ***Environmental Training of Personnel.*** Again a counterintuitive result is obtained. The statistically significant relationship is one wherein increased human resource training decreases compliance rate. However, this can be explained by looking at the scope and scale of personnel environmental training.

Environmental training is limited to PCOs and top management. Furthermore, the respondents mostly indicated that within this limited group, only a few actually are able to attend trainings. The respondents also stated that most trainees are given an average of only 2 to 4 hours of training *per year*. Thus, the limited scale and scope of training may not be sufficient to increase environmental awareness and reverse adverse levels of compliance rate. A clear entry point for policy would be to increase the scale, scope, and quality of environmental trainings.

5. ***Involvement of top management in environmental affairs.*** The increased involvement of top management again decreases compliance rate. In the survey, the respondents were asked about their perceptions on whether the firm has a proactive view towards waste management and whether the senior manager believes in environmental protection. Overwhelmingly the answer was that they either strongly

agree or simply agreed with these statements. However, these perceptions seem to be not translated into concrete actions as the statistical analysis show.

None of the external sources of pressure (economic, social, legal, and internal pressures) were found to be directly affecting compliance rate. However, *legal pressures seem to affect compliance indirectly through its effect on integration of environmental department with other units within the firm.* In particular, **legal pressures tend to increase integration.** Because integration, on the other hand, negatively affects compliance, it can be concluded that increased legal pressures indirectly decreases compliance rate. Though the integration-compliance relationship is vague as earlier discussed, the indirect relationship between legal pressures and compliance is more interesting. The interesting insight that can be gleaned has something to do with the EUF structure. The current EUF structure is such that the fixed cost dominates the variable fee. This could provide the wrong incentives for firms. Take for example a firm with BOD loading above 150 m^3/day. The firm will have to pay the fixed fee of 24,000 pesos regardless of whether he abates further or not. Thus, there is a stronger incentive not to abate further because it is not only costly but, at the same time results into no benefit in terms of reduced charges. This might mean that it is worth looking at the possibility of restructuring the EUF in such a way that the variable fee dominates the fixed fee. It is believed that this restructuring can result into further increases in the compliance rate.

The other question we want to answer is what actions do firms take when they observe their compliance rate? The statistical model in general shows that observed low rates of compliance results to: (a) More involvement of top management in environmental affairs of the firm, (b) Less integration of environmental departments with other units within the firm, (c) Increased spending on pollution abatement, and (d) Increased monitoring activities. The feedback effects and their implications have been discussed in the previous paragraphs.

Table 20. Results of Simultaneous Equation (EQS) Estimation

	Independent Variables					
	Average Compliance Rate	Top Management	Integration	Human Resources	Financial Resources	*Monitoring*
Average Compliance Rate	--	1.090	-134.646*	0.005	1.441*	*1.734**
Top Management	1.251*	--	-47.273	-0.520	-3.491	*4.126*
Integration	1.698*	0.161	--	4.121	0.722	*-1.562**
Human Resources	0.376*	0.712*	23.536	--	1.404*	*8.555*
Financial Resources	2.376*	2.167*	-18.753*	-1.045	--	*-0.742*
Monitoring	-1.688*	2.340	47.193*	-0.060	-2.359	--
Legal Pressure	0.313	0.314	30.972*	-0.578	-0.132	*-0.900*
Economic Pressure	-0.045	-0.681	-3.463	-0.585	1.061	*-0.939*
Social Pressure	0.042	0.138	7.411	-0.038	0.312	*0.340*
Internal Pressure	*0.276*	*-0.100*	*-8.168*	*-1.136*	*-0.153*	*-1.926*

** - significant at 5% level

7.0 DISSEMINATION RESULTS

7.1 PLIGHT OF REGULATED FIRMS

A dissemination seminar was given to the sample of regulated firms. We sent out a 9-page summary of the project's findings to the firms that were unable to participate in the seminar.

Five important issues[10] arising from our presentation were raised by the firms: The first is on our recommendation that they be proactive in collaborating with research and university institutions to improve their monitoring activities and compliance rate. The firms' reaction was that this collaboration will only be an *exercise in futility* as well as a costly endeavor because LLDA honors only the results of wastewater sampling coming from their own laboratory. While the Environment Mangement Bureau (EMB) of the DENR accredits certain laboratories, results from these accredited laboratories are not honored by LLDA insofar as renewing the firms'discharge permits is concerned. LLDA honors these laboratory results only in the submission of the self-monitoring reports (SMRs) by firms. In the past, firms have been doing split-sampling

[10] These same issues were also raised and confirmed by other non-survey firms (those that were located inside industrial estates) during the 2nd Laguna de Bay Lake Summit on Aug 22, 2006 which was attended by the project leader.

of their wastewater by accredited laboratories and LLDA. Firms claim that more often than not, their wastewater sample pass the standards according to results of accredited laboratories but LLDA laboratory results would unexpectedly show otherwise. Hence, firms will need to request LLDA for resampling of wastewater. This brings the 2nd issue to the fore. Firms lament that for the past 10 years, LLDA has taken an unnecessarily longer period of time to respond to firms' request for resampling, give or take *at least* two weeks lead time. With the penalty for non-compliance set at PHP1,000 per day of not meeting the standard, firms thus have to pay an additional cost of at least PHP 14,000 on top of the resampling fee. There is, therefore, the perception among firms that this delay in resampling is a 'money-making' activity by the regulatory agency. The suggestion is for LLDA to either start accrediting other laboratories and honor their results or LLDA expands its own laboratory services so as to accommodate more resampling requests per unit time and save the firms from unnecessarily high penalties. The 3rd issue is on the potential to reduce compliance costs of firms by way of getting the right information about the appropriate technology to use to enable them to meet the standard. While it may be true that some firms (the larger ones probably) have discovered and adopted the cost efficient pollution abatement technology, most firms are still in need of valuable technological information to enable them to comply at lower costs. Hence, these firms are requesting LLDA to provide this crucial information service on a regular basis if possible. The 4th issue is about asking LLDA for a 'basket of carrots', i.e., a package of incentives particularly for firms that have been performing much better than the 50 mg/li BOD standard (reaching as high as 80% off the standard). LLDA has to be made aware that the marginal cost of removing each kilogram BOD is significantly high yet some firms take it upon themselves to achieve very high compliance rates. The 5th issue concerns the firms' clamor that regulation must not be limited to industries since housheholds now account for almost 70% of the lake pollution. Hence, user fees should also be imposed on them. Industries believe they have been paying their dues for a long time and that they have responded well to the EUFS. It is time that households shared that responsibility. To this end, firms think that the local government units (LGUs) have a crucial role to play.

7.2 PLIGHT OF REGULATORY AGENCY (LLDA)

Three dissemination seminars have been presented to LLDA at the main office in Metro Manila. The first seminar was given on August 15, 2006 with the LLDA GM, and 3 Division staff as audience. The project team was requested to make a second presentation to the extended management committee (MANCOM) on August 23, 2006. The extended MANCOM consists of all division heads (e.g., Pollution Control Division, Laboratory Division, Legal Division, Training Division, Community Development Division) and some other designated representatives. A third presentation was made on October 19, 2006 with the staff of the Pollution Control Division and the Environmental Impact Assessment Unit as audience. There was some question regarding the validity and potential biasedness of the results considering that 89 firms may not be representative of the current population of more than a thousand regulated firms. But we explained that the target and appropriate population are the 177 stand-alone industrial firms regularly monitored by LLDA from 1999-2004 and not the relatively new entrants into the EUFS regulation since the older firms are in a better position to really evaluate the impacts of the EUFS. Eighty-nine (89) out of 177 is already 50% of the appropriate survey group. Besides, the results of the t-tests of means confirm the absence of sample selection bias. It is presumed that overall, the presentations were well received and appreciated.

The reactions to our recommendations as well as to the feedback from the firms are discussed below.

On the issue of laboratory accreditation, LLDA admits that it is the EMB that recognizes results from accredited laboratories. LLDA accepts these results only insofar as the submission of the SMRs by firms is concerned. But when it comes to the issuance of discharge permits and clearances, the LLDA does not honor results from EMB-accredited laboratories. Instead, LLDA conducts a separate sampling and relies on its own laboratory test results. From the LLDA's point of view, the purpose of the SMRs is merely to serve as an internal barometer of the firm that will guide them as to whether or not the quality of their wastewater discharge are within standard. The SMRs are used to compare the BOD loading of the firms as computed by LLDA with the values written in the SMRs. Should the SMR BOD loading be less than LLDA's computed value, then the firms will have to pay the corresponding differential in the EUF due the following year. On the other hand, if the SMR BOD loading is greater than that assessed by LLDA, then the corresponding difference in EUF will be deducted from user fees due the following year. In response to the issue of firms often failing LLDA sampling tests, LLDA suggested that this differential could probably be due to a host of factors: The dates when monitoring is done by LLDA and the firms are usually different and therefore this alone could already account for changes in effluent characteristics that eventually impact on the BOD level. At most, LLDA only monitors firms once every quarter. Cognizant of the fact that the characteristics of the effluent are highly changing, LLDA thus requires the firms to do self-monitoring activities for firms to be able to watch their environmental performance and be assured of compliance when the LLDA comes for a surprise inspection. So if the firms fail during inspections, LLDA conjectures that it could be because of troubles with their effluent on that particular day. A controversial insight was voiced out pertaining to the deliberate dilution of the split sample by some pollution control officers (PCOs) of the firms to make it appear that their wastewater sample passes the standard in order to avoid being reprimanded by their respective management. Thus, when LLDA laboratory staff performs its own analysis, the sample actually fails to meet the standard.

On the 2nd issue concerning alleged prolonged period before resampling, LLDA commented that the countdown for imposing the penalty of PHP1,000 per day of non-compliance starts on the day that firms make a letter of request for resampling. LLDA counters that there are firms that already hand in such a request even just a day after the 1st actual sampling was done—and LLDA perceives this act as dubious because there is no way a firm can make technological and operational adjustments to improve its environmental performance in just one day! Nevertheless, in the event that a firm passes the standard after the resampling is done, then firms need not pay the penalty; if it fails the resampling test, then the penalty of PHP1,000 per day is retroactive to the date that the request is made. LLDA management will sit and talk about the pros and cons of accreditation and/or expansion of laboratory services.

On the 3rd issue regarding provision by LLDA of valuable information on appropriate cost efficient technology for pollution abatement, LLDA said that its training module for the environment is good, but firms are hesitant to accept what they are teaching them. LLDA also claims that it does provide the firms with best practices and success stories as well as technical information on the appropriate technologies that may be used for pollution abatement. However, if what the firms actually want is for LLDA to dictate what technology the firms should use, then LLDA is not inclined to do

this because it will certainly be blamed should the suggested technology fail. LLDA has no hands-on experience with various abatement technologies and is therefore not in the position to dictate what technology would work for a certain company. More importantly, it also perceives that patronizing a particular technology could likewise be a potential source of corruption. To date, and partly due to information derived from our presentations, LLDA mangement has initiated the listing down of technical consultants who can presumably be tapped to share information on cost efficient pollution abatement technology with regulated firms.

On the 4th issue concerning incentives, LLDA management will see what can be done.

Regarding our suggestion of possibly reviewing and/or revising the EUF structure so that the fixed fees be reduced and the variable fees increased, LLDA voiced out that efforts are already being made toward this direction.

In addition, the team also suggested that LLDA can come up with some sort of a sector-based computation of the EUF to at least give consideration to the differences in the nature of prodcution processes across subsectors that may likely put some sectors at a disadvantage. For instance, agricultural industries will discharge relatively higher amounts of BOD due to the naturally organic production process involved while the pulp and paper sub-sector as well as the garments and textile subsector may find it relatively more difficult and costly to significantly reduce volume of wastewater discharge because the production process inherently requires large volume of water, and consequently, higher volume of wastewater. LLDA replied that they have started implementing a similar 'trial scheme' with the fast food industries. Gasoline stations are making the same request for consideration.

8.0 CONCLUSIONS AND ENTRY POINTS FOR POLICY INTERVENTION

This study relied on several sources of information: a) a survey of 89 firms regularly monitored by the Laguna Lake Development Auhtority (LLDA) from 1999-2004; b) 88 Non-surveyed and 89 Surveyed firms with self-monitoring reports (SMRs) for 2002 and environmental performance indicators for 1999-2004; and c) dissemination seminars for firms and the regulator. Hence, this concluding section is an integration of the insights from each of these sources.

In general, the EUFS has been successful in inducing changes in pollution abatement behavior of firms. This is specifically reflected by the decreasing trends in the average EUF paid and variable fees as well as in BOD loading and concentration over the period 1999-2004. Moreover, the majority of firms, on average, have reduced the volume of wastewater discharges and wastewater treatment facilities have been installed although for one-third of the respondents, treatment facilities have been put up even before the EUFS implementation. Around 20-40% of firms have either reduced, substituted or eliminated harmful chemicals in response to the regulation. More importantly, 75% of the sample firms are not simply complying with the standard of 50 mg/liter BOD but are actually, on average, performing 80% better than the standard.

Given the above findings, the good news is that firms have responded positively to the EUFS. But the bad news is, it is a very costly response that makes the regulated firms less competitive, among other things. There is reason to believe that compliance rates can be further improved and compliance costs can also be potentially reduced. While some firms seem to be still locked into a trial and error approach in determining the appropriate abatement technology that inevitably results to cost inefficiency and unnecessary waste of financial resources, other firms have overcome this technological information barrier. We have initially recommended that firms be more proactive and link up with research institutions to improve their monitoring capablilities and technological know-how. However, during the dissemination seminar, regulated firms voiced out their skepticism over this suggestion because past and present experience revealed that LLDA does not honor the test results of accredited laboratories other than its very own except for purposes of submitting the firms' SMRs. This implies that LLDA also does not honor the effluent information on the firms' SMRs for purposes of issuing discharge permits. LLDA's argument is that differences in test results are bound to occur because a lot of factors can affect the characteristics of the effluent. For the past 9 years since the EUFS has been enforced, this lack or absence of trust between regulated firms and the regulator has persisted and it will continue to persist unless a potential resolution that is agreeable to both parties is arrived at. A possible entry point for policy intervention is to standardize and/or harmonize the laboratory procedures or processes for handling and analyzing wastewater samples so it can pave the way for LLDA-accredited laboratory firms whose test results will no longer be perceived as dubious by either party.

In relation to the above, avenues for regular sharing of technical information on pollution abatement can be facilitated by LLDA since firms perceive that this information will greatly improve their environmental performance and at the same time cut on abatement costs[11].While trainings and seminars that include technical information on pollution abatement technology are already being conducted by LLDA, the fact that firms still raise this issue implies that the scope and scale of these trainings and seminars can be expanded.

We have also initially suggested a possible review and revision of the EUF since the current fixed fees seem to be giving the wrong signals to firms. Increasing the variable fee and reducing the fixed fees may encourage higher compliance rates. However, LLDA said that efforts along this line are already under way, although nothing is definite yet.

9.0 LIMITATIONS OF THE STUDY AND AREAS FOR FUTURE RESEARCH

As in any research that aims to perform robust statitical analysis, a large number of observations would be ideal. However, doing surveys is dependent on the willingness of respondents to be part of the sample. In this study, we have gone to such great lengths and costs to enjoin firms to participate but we managed to cover only 89 firms. It would have been ideal to have surveyed all the 177 stand-alone industrial firms that were regularly monitored by LLDA from 1999 to 2004.

[11] LLDA has initiated such a move with certain firms located in industrial parks and estates (Eco-Index) but it appears that a greater number of firms outside these estates do not have the same access to this shared information.

Areas for future research may include looking at marginal abatement costs (MAC) of firms and determining the factors affecting MAC. From the viewpoint of policymaking, information on firms' MAC could be a valuable input in designing or revising user charges like the EUF.

Information that will shed more light on the package of incentives that will enhance compliance rates among regulated firms may also be an important research thrust. So will determining the factors that will induce regulated firms to truthfully reveal information in their self-monitoring reports (SMRs) as likewise suggested by Montenegro (2006) .

One of the main results of the study is the fact that firms, because of lack of access to appropriate technology (ies), are locked in a cycle of increasing investments on ineffective technologies in order to comply with standards. This result warrants further testing. One way to test this is to actually split the sample firms by technology categories. For example, engineering data on the type of technology they are currently using can be a means of classifying the firms according to the type of abatement technology. However, we currently do not have sufficient information in our survey data to be able to perform a more rigorous analysis on this. Future studies may want to include this as an item in their survey.

An alternative would be to use technology dating as a rough measure of technology access. Firms will be classified according to the most recent date they have acquired their technology or invested in abatement technology. It is implicitly assumed that firms acquire the latest possible technology at the date of investment or acquisition. Furthermore, it is also assumed that older technology is less efficient than the latest technology. Once this is done, separate runs for firms in each category can be performed and the estimates or results compared for each category. If the costly investment loop hypothesis is robust then we would expect this relationship not to hold for firms who acquired abatement technologies at a later date. Differences in the number of firms in each category can however be a factor that can affect the analysis. That is differences in the estimates can be attributed more to the differences in sample sizes. To overcome this one can use "bootstrapping" procedures instead to generate the estimates from each category.

Tempting as it is, these however cannot be done due to the very limited sample size we have. Splitting the sample further will reduce the degrees of freedom and thus the validity of the results. It is left to future researchers interested in the topic to further investigate this intriguing hypothesis.

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APPENDIX TABLES

Appendix Table 1. Legal Pressure Index[12]

	Factor 1		Factor 2	
Interpretation	Factor Loadings	Scoring Coefficients	Factor Loadings	Scoring Coefficients
Average EUF	0.775	0.639	0.335	0.311
# of Cease and Desist Orders	0.725	0.693	-0.281	-0.284
# of Notice of violations	-0.006	-0.021	0.920	0.887

Appendix Table 2. Economic Pressure Index

	Factor 1	
Interpretation	Factor Loadings	Scoring Coefficients
Sell products in the U.S.	0.877	0.380
Sell products in Europe	0.858	0.372
Sell products in Asia	0.816	0.354

[12] Highlighted entries represent the selected components for the first factors that were used in the regression analysis

Appendix Table 3. Social Pressure Index

Interpretation	Factor 1	
	Factor Loadings	Scoring Coefficients
# of Complaints	0.576	0.613
# of Times listed as a Polluter	0.576	0.613

Appendix Table 4. Internal Pressure Index

Interpretation	Factor 1		Factor 2	
	Factor Loadings	Scoring Coefficients	Factor Loadings	Scoring Coefficients
Year listed in any Foreign Stock Exchange	0.839	0.513	0.116	-0.029
# of plant employees	0.468	0.253	0.311	0.177
Year listed in the Phil Stock Exchange	0.839	0.534	-0.060	-0.168
Company made profits in the last fiscal year	0.153	-0.008	0.733	0.553
Company has plants in other countries	-0.004	-0.121	0.824	0.647

Appendix Table 5. Involvement of Top Management in Environmental Issues

Interpretation	Factor 1		Factor 2	
	Factor Loadings	Scoring Coefficients	Factor Loadings	Scoring Coefficients
Plant has a pro-active view of the environment	0.948	0.314	-0.066	-0.033
Plant's senior mgt. belief in envt'l protection	0.933	0.308	0.022	-0.008
Manager's performance review tied with waste mgt. performance	0.930	0.306	0.056	0.023
Rank of chairperson in Board of Directors Waste Management Comm.	0.619	0.205	0.013	-0.007
Presence of waste mgt committee in the Board of Directors	-0.054	-0.040	0.770	0.682
Company's senior manager's belief in env't protection	0.090	0.008	0.734	0.646

Appendix Table 6. Integration Between Env't Services and other Admin Units

	Factor 1		Factor 2		Factor 3	
Interpretation	Factor Loadings	Scoring Coefficients	Factor Loadings	Scoring Coefficients	Factor Loadings	Scoring Coefficients
Redistribution of responsibilities due to waste mgt. system	0.842	0.544	0.018	0.001	-0.040	-0.230
Year waste mgt. policy was instituted	0.783	0.438	0.072	0.053	0.247	-0.001
Nature of contact with top mgt.	0.296	0.185	-0.136	-0.100	0.017	-0.064
Nature of contact with R and D dep't.	0.011	0.033	0.808	0.570	-0.146	-0.076
Year firm was registered as ISO 9000 company	0.044	-0.162	-0.118	-0.051	0.800	0.574
Year firm was registered as ISO 14000 company	0.204	-0.067	0.045	0.065	0.820	0.557
Existence of env't department	-0.577	-0.275	-0.027	-0.029	-0.383	-0.146
Nature of contact with engineering dep't	-0.078	-0.078	0.844	0.606	0.080	0.113

Appendix Table 7. Personnel Management and Environmental Issues

	Factor 1	
Interpretation	Factor Loadings	Scoring Coefficients
Extent of personnel env't. training in the last 5 years	0.825	0.371
Extent of administrative employees' env't. training in the last 5 years	0.770	0.347
Extent of supervisor's env't. training in the last 5 years	0.652	0.294
# of hours of env't training of production employees	0.534	0.241

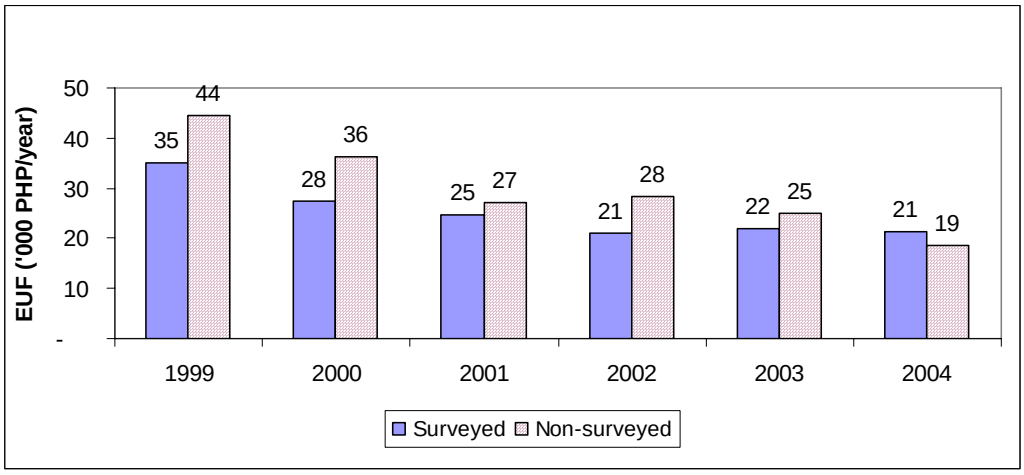
Appendix Table 8. Physical and Financial Resources Allocated to Improving and Maintaining Environmental Performance

	Factor 1	
Interpretation	Factor Loadings	Scoring Coefficients
Year primary waste treatment system was established	0.790	0.404
Year secondary waste treatment system was established	0.729	0.373
Year secondary effluent treatment system was established	0.683	0.350
Increased financial resources of env't. dep't.	0.254	0.130

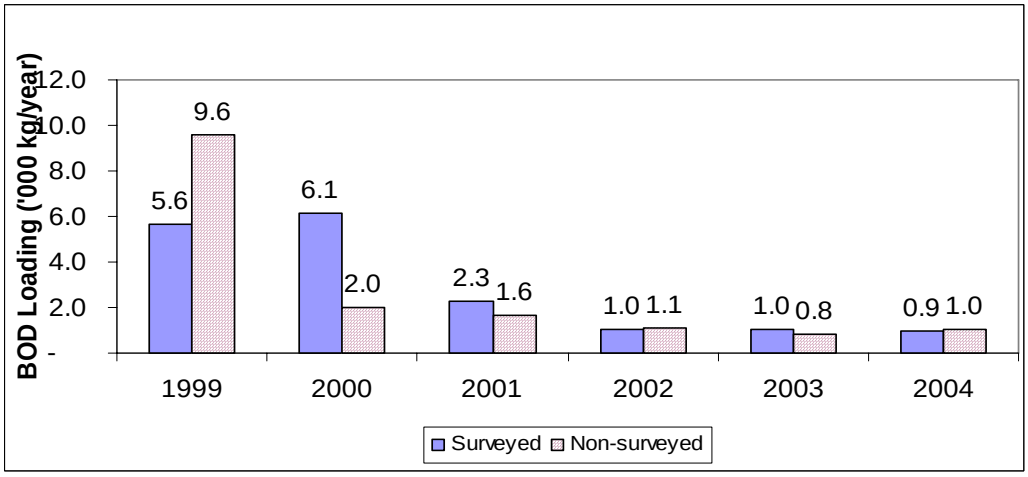
Appendix Table 9. Monitoring System and Activities

	Factor 1		Factor 2	
Interpretation	Factor Loadings	Scoring Coefficients	Factor Loadings	Scoring Coefficients
Collaborative monitoring with industry research centers	0.957	0.323	0.078	0.010
Firm owns a research centre or laboratory room	0.952	0.321	0.077	0.010
Collaborative monitoring with university research centers	0.949	0.322	0.035	-0.024
# of years doing monitoring or regular testing	0.463	0.160	-0.034	-0.053
# of waste audits in the past 5 years	0.132	0.003	0.771	0.614
Plant does waste audits	-0.082	-0.072	0.804	0.652

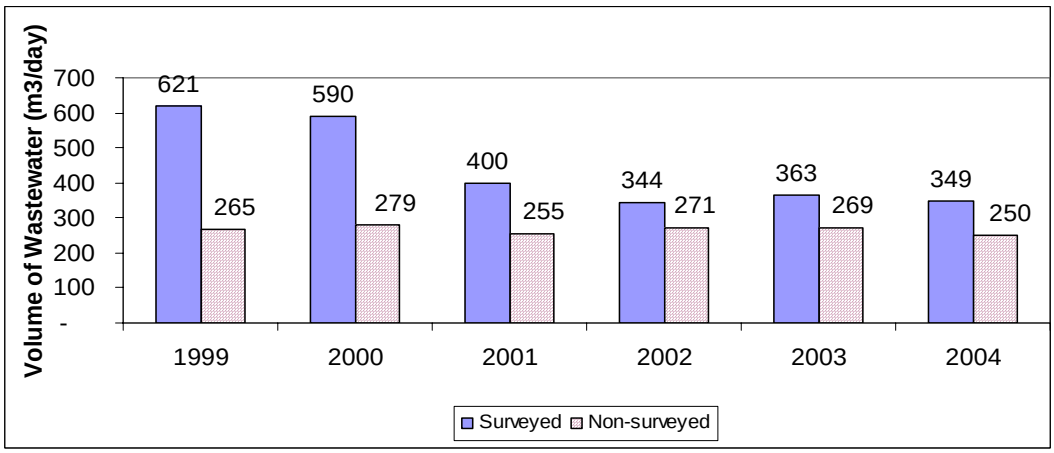
APPENDIX FIGURES



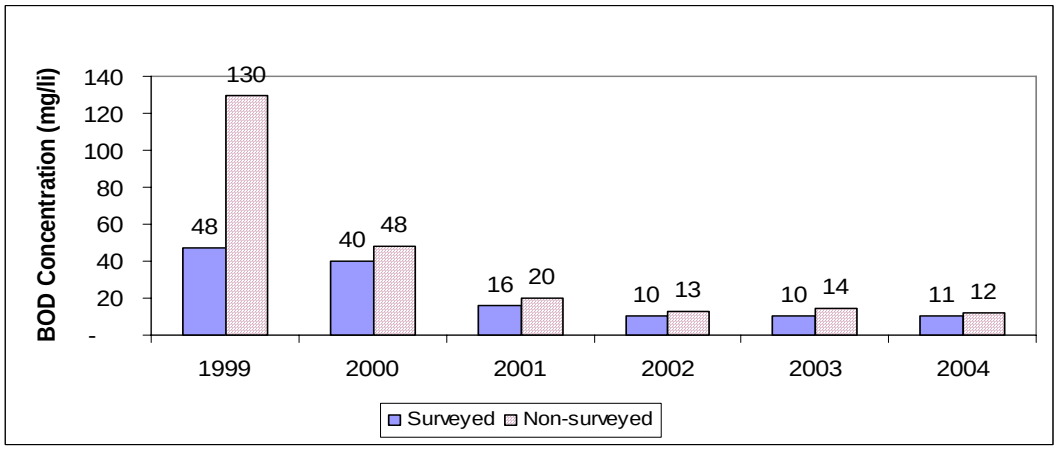
Appendix Figure 1a. EUF Paid, Surveyed and Non-surveyed Firms, 1999-2004



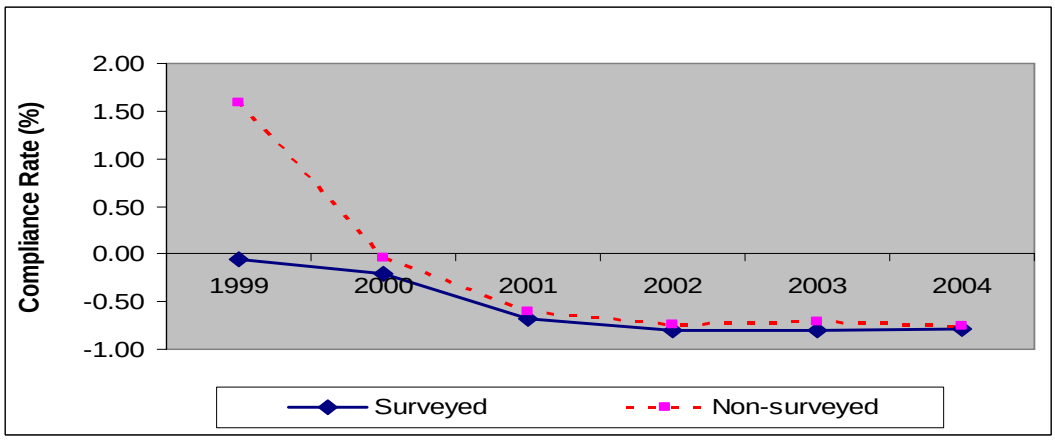
Appendix Figure 1b. BOD Loading, Surveyed and Non-surveyed Firms, 1999-2004



Appendix Figure 1c. Volume of Wastewater Discharge, Surveyed and Non-surveyed Firms, 1999-2004



Appendix Figure 1d. BOD Concentration, Surveyed and Non-surveyed Firms, 1999-2004



Appendix Figure 1e. BOD Compliance Rate, Surveyed and Non-surveyed Firms, 1999-2004