Firms Compliance Behaviour With Environmental Regulations In Malaysia

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Article Information

Abstract

Malaysia has not been exempted from facing environmental pollution problems as a result of the rapid development of the manufacturing sector.The manufacturing sector is the main driver of the economic growth of this country but it is also the second biggest contributor to the pollution of the rivers in the country. As the operations within the manufacturing sector compete hard to maximise their profits they must also give due consideration to the costs of waste treatment in the production process. This consideration will influence their behaviour to comply or otherwise with the regulations. The behaviour is similar to the criminal acts explained by Becker (1968). The purpose of this study is to identify the factors that influence the industry's compliance to the effluent treatment regulations for manufacturing industries in the states of Pulau Pinang, Kedah and Perlis. A modified Becker's criminal behaviour model was used to estimate the dichotomous compliance results. The approach taken in conducting the study was utilisation of a structured questionnaire followed by non-parametric statistical test analyses to analyse the feedback from the 42 factories involved. Findings from the study show that the level of compliance is influenced by the probability of being fined and the number of inspections. Besides that, the enforcement authorities in Pulau Pinang had managed to create an enforcement reputation amongst the factories compared to those in Kedah and Perlis. Results of the analysis suggest that the environmental protection policy must ensure a reputation for enforcement, a systematic inspection strategy and informal control mechanisms such as pressure from the public and NGOs must be empowered.

INTRODUCTION

The manufacturing sector is the largest contributor to Malaysia's economic growth but it is also the second biggest contributor to river pollution. Over the last decade, Malaysia's economic growth has been driven by the manufacturing sector which accounted for 30.8% of the GDP , 82.4% of total value of exports and 27.6% of labor force (8th Malaysia Plan).The manufacturing industry is projected to grow at the average rate of 5.7% for the period 2010 – 2015 which makes it as one of the sectors that will be given attention in the 10th Malaysia Plan. On the other hand, the Department of Environment (DOE) annual report of 2010 showed that the manufacturing sector was responsible for 44.57% of the total sources of water pollution; second only to domestic sewage. The situation has not shown much changes since 2007 when the manufacturing sector was the leading source of water pollution then, ahead of agriculture and livestock.

In the effort to manage pollution issues, many countries use a multitude of approaches, from command-and-control systems to market based incentives. In Malaysia, the Environment Quality Act 1974 is seen as adequate and sufficiently comprehensive to control industry behaviour. However, the effectiveness of regulations is dependent on the firms decision to comply; which in turn is based on cost and benefit considerations. To be more specific, compliance to environmental regulations is driven by enforcement activites in order to effect a change in the behaviour of firms. Cohan (1999) mentioned that understanding a firm's actions is the key to the development of an effective enviromental policy. Individual and organizational behaviour towards the decision to comply to regulations was first developed using the Becker (1998) criminal act model. The Becker model, also known as the optimal fines theory, is build on the premise that potential commitment of a crime is linked to the probability of being caught and subsequently penalised if found guilty. In the literature, amongst the earliest to use this model is Downing and Watson (1974), Harford (1978) and Storey and McCabe (1980).

THE INDUSTRIAL DEVELOPMENT AND ENVIRONMENTAL QUALITY CONFLICT

Developing nations, especially those in Asia, experienced rapid development in the practice of industrial pollution control standards, similar to that of the developed nations (Hettige et al., 1996). This is following the industrialzation process taking over the role of the agriculture sector as the engine for economic growth in most countries. Eventhough the drop in the quality of the river water is also attributable to agro-based industrial activities (oil palm and rubber), livestock farms and land clearing activities, industrial waste and chemicals became the main source of river pollutants as of the mid-1980s (Jamalunlaili, 1997).

As an effort to control pollution, the government drafted the very comprehensive Environmental Control Act 1974 and the Department of Environment (DOE) was entrusted with its enforcement. Control of effluent discharge was enforced under the Environmental Quality Regulations (Sewage and industrial effluents) 1979 on 1 January 1981. The regulation placed effluent waste and sewage together when in reality, they have different standard characteristics. Following that, the enforcement of industrial effluent standards were separated from that of sewage through the gazzeting of the Environmental Quality Regulations (Industrial Effluents) 2009 on 10 December 2009.

Despite the various enforcement measures taken by the DOE, the level of compliance has not changed much in the past ten years. The annual DOE report shows that some indusries consistently had low compliance average for the period 2000 – 2009. Included among them were the food and beverage industry, electroplating and metal finishing, animal feeds, and textile. These industries were identified as having difficulties complying with the regulations and their compliance level were consistently below the overall average for the nine year period 2000 – 2009.

LITERATURE REVIEW

The effects of enforcement on the level of compliance to environmental regulations were the focus of studies by researchers such as Magat and Viscusi (1990), Gray and Deily (1996), Laplante and Rilstone (1996), Earnhardt (2004) and Shimshack and Ward (2008).

Magat and Viscusi (1990) were amongst the early researchers to look at the effect of inspection on effluent discharge by the paper and pulp industry in the United States of America. They discovered that inspection could

result in the reduction of BOD load by almost 20%. This study led to other similar studies, one of which was by Laplante and Rilstone (1996) who carried out further analysis on the same industry in Canada. In their studies they took into consideration the effect of the threat of inspection not only on the level of compliance but also on the level of discharge which exceed standards. According to the requirements, each factory is required to submit a monthly report on the released BOD load and the TSS, including the level of permitted effluent discharged by every factory per month. The data collected had the advantage of enabling an analysis on the effects of the current rate of discharge but also on the relative effects compared to the permitted discharge rates. The results showed that inspection and the threat of inspection showed a significance negative relationship to the discharge of pollutants. Besides that there was also evidence that inspection contributes to the increase in the frequency of reports on the releases made by the factory.

The study by Gray and Deily (1996) attempted to identify if enforcement actions had an influence on the compliance behaviour of the factory and vice-versa, if a factory's compliance level has an effect on enforcement. Three main models were analysed using air pollution data from 41 steel factories in the USA for the period 1980 -1989 by utilising logit and tobit regression models. The findings showed that the compliance results were influenced by the enforcement or in other words the greater the enforcement, the higher the level of compliance. The big factories though, tend to be less compliant to the air pollution regulations. The compliance behaviour was also found to influence enforcement with less enforcement being carried out for factories with higher level of compliance.

Most of the studies involved environmental regulation compliance by factories or the private sector. However, government-owned entities with utility maximization motives such as public treatment plants also take into account costs and benefits in the effort to improve the quality of the environment (Earnhardt 2004). Despite the entities having different motives, any behaviour towards compliance to the quality of the environment would have to look at the costs and benefits. Shimshack et al. (2005) noted that the enforcement body must not only be efficient in conducting preventive and enforcement activities, its reputation is also important in influencing compliance behaviour. The researchers tried to find the relationship between the effects of imposing fines and other previous enforcement actions. Fines were found to be capable of acting as a deterrent towards future non-compliance, and it also gives a signal to the other factories on the readiness of the enforcement body to fine errant factories. The results of these studies show that the imposition of fines managed to reduce the number of non-compliance cases by two-thirds. It also had an influence on the other factories.

Compliance behaviour is not only influenced by formal regulation but also informal regulations (IR). Pargal and Wheeler (1996) defined IR as implicit imposition of fines or shadow price for pollution offenses. Kathuria (2007) mentioned about IR as a potential medium for industrial pollution control through the mechanism of 'information disclosure' and 'ranking'. The effectiveness of IR in changing the behaviour of industry is more prominent in situations where formal regulation is weak or non-existent, especially in the developing countries (Pargal et al; 1997a, Pargal et al; 1997b, Hettige et al; 1996). Pargal and Wheeler (1996) pioneered the studies on the effect of IR in Indonesia where formal regulation did not exist, through a regulations model based on the modified market. It makes use of the premise that the society must apply pressure in situations where the information on industrial pollution is weak and difficult to obtain. They must put pressure on the employees, the factory owner, use publicity to bring down the image of the offender, issue threats or use of violence, civil laws, and pressure from politicians, local administrators and religious leaders.

A lot of studies on the effect of IR and its ability to change the industry compliance have been carried out in the developed countries (see Hamilton 1995, Lanoie et al; 1998) and also the developing countries (see Gangadharan, 2006; Pargal and Wheeler, 1996; Pargal et al.; 1997a). IR through the use of the stock and capital markets, and links with media coverage have been seen to be effective in the developed countries, where as pollution control in the developing nations tend to be more through community pressure.

METHODOLOGY

Becker's basic model states that individual utility from acties that contravene the law, EU depends on the financial returns from going against the law Y, the probability of being arrested P, and the forecast financial penalty F.

$$EU = (1 – p) U (Y) + pU(Y –F) ....(1)$$

An individual will be inclined to break the law when returns from the illegal activity (Y) exceeds the expected financial penalty for breaking the law. The individual will comply with the regulation when EU is negative. EU is negative if the expected financial penalaty is bigger than the expected financial returns from the criminal activity (F>Y).

Brown and Reynolds (1973) took into account the individual's wealth as a factor so that the equation becomes as follows:

$$EU = (1-p)U(W+G)+Pu(W-L)$$
Where;
> W= the individual's current wealth
> G= the potential gain from the criminal activity
> L = the loss if arrested
> p = the probability of being arrested

The individuals current wealth is more rational. This due to the reason that if an individual is arrested and penalised due to the illegal activity, the individual is still inclined to carry out the criminal activity if L<W. Dowell, Goldfard and Griffith (1998) and Hatcher (2000) included social norm values (M). They expanded the utility forecast model to:

$$EU= m(M)[(1-p)]U(W+Y)+Pu(W-F)]$$

m( ) is the reduced social norm function (1≥m(0)≥0) which represents the effect of social norms to compliance with the index M. A small M value refers to weak moral values (for example a wrongdoing is considered as not really that bad). A high M value indicates strong moral values. This enables the informal regulation (IR) influencer index to be included as a compliance determinant in this study.

Industry Compliance Behaviour Model

The factors that influences a factory's compliance to effluent regulation is simplified as in Figure 1. The industry's compliance is not only influenced by the probability of inspection (PINS) and gains from the illegal activities (IGAIN) but is also influenced by the incident of being penalised (dPEN), the probability of being penalised (P_PEN), the number of inspections (N_INS), the informal regulations pressure (I_IR) and industry characteristics variables. As such, Becker's model in equation (1) is modified to include additional variables as shown in figure 1

Data Collection and Scope of Study

The primary source of data is through the use of a structured questionaire. The study looked at compliance behaviour of three industries (food and drinks, textile, and paper) which are subjected to the Environmental Quality Regulations (Industrial Effluents) 2009 in three states of Malaysia namely Pulau Pinang,Kedah and Perlis. The basis of choosing these three types of industries is the annual Department of Environment (DOE) report which shows that these three industries have difficulties in complying with the effluent regulations.
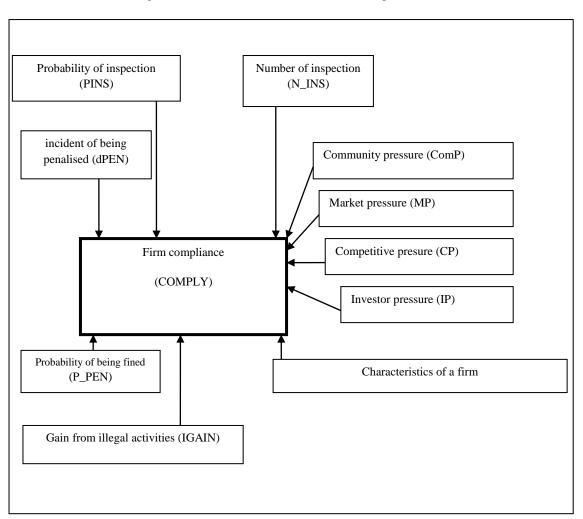
Figure 1: Theoretical framework of Firm Compliance Behaviour

Variables and Measurement

The primary variable of the study is the level of compliance (COMPLY). The level of compliance of the firms to the effluent discharge regulations is based on their self assessment to five questions, where the firms are required to state the priority level of each factor in encouraging the proper management of the firms effluent over the last five year period. Likert's five scale is used, that is '1=not a priority' and '5=highest priority'. Following that, each factory's level of compliance is determined by using cluster analysis based on the answers given. According to Everitt (2002) cluster analysis is a method used to build informative classification and can justifiably be used for a set of data that originally had not been classed, by using each individual's variable characteristics.

For the probability of inspection (PINS) variable, the management is asked about their perception on the probability of being inspected in the next 12 months in the form of percentage likelihood. The study uses the percentage cost of operation and maintenance of the effluent treatment system, as the proxy for gains from not complying with the regulations (IGAIN). The expected relationship between compliance and operations & maintenance cost is negative, that is a factory with high effluent treatment cost, will be inclined to not comply. To measure the probability of being penalised, (P_PEN) is asked about the possibility of being penalised if they were to get an inspection visits from officers of DOE in the next 12 months period. The percentage value ranges from zero to one hundred percent with 5% interval in between.

Wu (2009) provided clear information on how to form the index for informal regulation influence variable (I_IR). The I_IR variable is formed based on four pressures, these being community pressure (ComP), competitive pressure (CP), investors pressure (IP) and market pressure (MP). In the questionaire the factory, was asked to determine the level of influence of each factor had in managing the environment during the immediate 5 year period. Likert's 5 point scale was used to give an indication of the level of influence of each factor. (1=does not influence; 5=highly influential). Multi-type question was asked to determine the influence each factor had. Since a lot of questions were asked for each of the factor, it is impossible to use each of them as a seperate variable. To overcome this problem, an average value is calculated for each informal regulation component, and these for were then averaged again to arrive at the informal regulation variable. The premise was then asked a direct question on the penalty incident or the issuing of a notice or being taken to court by the DOE for the failure to comply to the effluent discharge regulation in the year 2010. The dummy variable is coded for dPEN variable with a binary value '1' for yes (penalised) and '0' representing no.

Analysis Method

Hypothesis testing in this study is carried out by looking at the difference between two independent samples. In general, there are two methods of testing, that is parametric test or non-parametric test. Parametric test requires the assumption that the variable is normally distributed and if this condition is not satisfied, then a non-parametric test is more suitable (De Vaus 2002). To determine the proper analytical tool to be used, the normality test using Shapiro-Wilks statistic was carried out to determine the nature of distribution of the variable. A method for testing is then decided.

THE RESULTS

Sample size

Table 1 shows that the paper and pulp industry gave excellent cooperation with regard to the questionaire with 64.7% response followed by textile (60%) and food & beverage (55%). The rate of response from Pulau Pinang was the highest with 59.3% followed by Kedah with 50%. The response from Perlis was 100% but the population size is relatively small (1.4%) compared to Pulau Pinang (81.9%). Data used in the study accounted for 58.3% of the population (72 factories). This rate exceeds the recommendation by Neuman (2003) who said a sample size equivalent to 30% is sufficient where the population is less than 1000. As such the data is believed to be sufficiently representative of the manufacturing industry population in Nothern Peninsular Malaysia.

Table 1: Survey Response Rate

Industry/State	Response Rate							
	P.Pinang		Kedah		Perlis		Total	
	n/N	%	n/N	%	n/N	%	n/N	%
Food & Beverage	18/30	60	3/9	33.3	1/1	100	22/40	55
Textile	8/14	57.1	1/1	100	-	-	9/15	60
Paper & Pulp	9/15	60	2/2	100	-	-	11/17	64.7
Total	35/59	59.3	6/12	50	1/1	100	42/72	58.3

Industry's Demographic Profile

Table 2 shows the summary of the industry profile. From 42 premises involved, 52.4% were from the food and beverage industry followed by the paper and pulp industry with 26.2%. The accuracy of response needed in answering the questionaire requires the respondent to have the necessary information about the company, especially management of effluent discharge. 42.9% of the questionaire were answered by an assistant manager while 7.1% were by health and safety managers-individuals with complete knowledge for the factory's effluent waste management aspect. The remaining 28.6% were answered by excutive level employees such as supervisor, human resource excutive, engineer, production excutive and safety and health excutive. Geographically the premises were mostly located in the industrial zone (78.6%) with Pulau Pinang the most obvious (80%) followed by Kedah and Perlis (67%). The average age of the factories was 31.6 years. In terms of ownership and status, 90.5% were locally owned and 42.5% were multinationals. The distribution of the age

of talk management personnel showed that 35.7% belonged to the 51 to 60 age group, followed by 33.3% in the 41 to 450 age group.

Table 2: Industry Characteristics are Subject to Environmental Quality (*Industrial Effluent*) *Regulations 2009* in Penang, Kedah and Perlis

No.	Characteristics	Frequency	Percent (%)
1	Type of Industry:		
	Food & Beverage	22	52.4
	Textile	9	21.4
	Paper & Pulp	11	26.2
2	Position of Respondent:		
	Plant Manager	9	21.4
	Assistant Manager	18	42.9
	Manager of Environmental Health and Safety	3	7.1
	Others	12	28.6
3	Location of Plant:		
	Industrial zone	33	78.6
4	Age of factory	31.6 (average)	
5	Ownership:		
	Local	38	90.5
6	Level of business:		
	Multinational	19	45.2
7	Distribution age of top management		
	31-40	4	9.5
	41-50	14	33.3
	51-60	15	35.7
	61 and above	9	21.4

42.9% of the questionaire were answered by an assistant manager while 7.1% were by health and safety managers- individuals with complete knowledge for the factory's effluent waste management aspect. The remaining 28.6% were answered by excutive level employees such as supervisor, human resource, excutive, engineer, production excutive and safety and health excutive. Geographically the premises were mostly located in the industrial zone(78.6%) with Pulau Pinang the most obvious (80%) followed by Kedah and Perlis (67%). The average age of the factories was 31.6 years. In terms of ownership and level of business, 90.5% were locally owned and 42.5% were multinational company. The distribution of the age of top management personnel showed that 35.7% belonged to the 51 to 60 age group, followed by 33.3% in the 41 to 450 age group.

Cluster Analysis: Developing Compliance Variable

An industry's compliance level is determined using a self assessment questionaire containing multiple item questions. Five of the items refer to formal regulation factors that requires the factory to decide on the priority of each of them in the management of effluent discharge. If the item is important in the management of effluent the factory would be categorised as complying with the regulation or other wise. Cluster analysis is used to classify the level of compliance based on similarity of characteristics between factory using agglomerative hierarchical clustering procedure. The study found that 67% of the 42 factories complied with the regulations. Table 3 shows the comparison in terms of percentage compliances between DOE annual report and cluster analysis result. Compliance in Pulau Pinang was 66% compared to the DOE data of 67% and 86%. However, the compliances data from DOE in 2010 represented the level of compliance for the whole of the manufacturing industry which included compliance to regulations for effluent, sewage, scheduled materials and clean air. As such the 2009 data would be more accurate as it refers to compliance to Environmental Quality (sewage and industrial effluent) 1978. Compliance by the industry in the state of Pulau Pinang did not show much difference between the two sets of data with the exception of the paper industry at 56% is relatively low compared to the DOE data. As for the Kedah, cluster analysis showed a compliance rate of 66%, a far lower figure than 99.75% as reported by DOE. However, as previously with Pulau Pinang, the compliance rate was for effluents and sewage for the

year 2010. The difference in percentage compliance between the two data sources is realistic based on several factors:
(a) The method of measuring the compliance level are different (b) The compliance data from the DOE is from a mixture of regulations (c) The study sample covered only three industries from three states whilst the DOE data covered all industries. As such the level of industry compliance obtained in the study through the use of several questions is realistic and the difference with the DOE is not obvious.

Hypothesis 1

The first hypothesis is on whether the effect of formal regulations is different in influencing the level of industry compliance and what is the form of relationship between formal regulation and compliance. Two conventional enforcement tools are inspection and imposition of fines which have been proven in the list of literature to be capable of influencing the level of compliance. As the testing the hypothesis requires interval or ratio data form, the probability of inspection variable (PINS) and the probability of fines (P_PEN) are most suitable because it can potray the industry's perception towards enforcement. Other than that, the actual inspection count experienced by the industry variable (N_INS) is also chosen to look at the effect of inforcement.

Table 4: Summary of Mann-Whitney Test and Spearman's rho coefficient Between Probability of Fine, Probability of Inspect and number of inspection with Level of Compliance

		n	Mean	Mann-Whitney		Spearman's rho	
				Statistic U	p-value	statistic	p-value
P_PEN	Compliant	14	.08	96.5	.004***	-.455	.002***
	Non compliant	28	.29				
PINS	Compliant	14	.65	158.0	.304	.160	.310
	Non compliant	28	.56				
N_INS	Compliante	14	1.07	110.0	.013**	-.387	.011**
	Non compliant	28	1.79				

Note: * significant at $\alpha = 0.10$
** significant at $\alpha = 0.05$
*** significant at $\alpha = 0.01$

The Mann-Whitney statistical test showed a significant difference in the probability of penalty between compliant and non-compliant factory at 0.01 significant level (Table 4). Other than that, Spearman's correlation coefficient, rho, showed that both variables are negatively related and significant at the 0.01 significance level. This means the expected probability of penalty is higher (0.29) for a factory which is non-compliant and the probability of penalty increases with the decrease in the level of compliance. This situation was explained by Downing and Kimball (1982) who stated that the decision to comply is done based on cost and benefit. Due to the industry being able to forecasts the probability of its premises being penalised and its knowledge of the history of compliance, the industry is therefore ready to go against the regulation even to a high level of penalty threat on the assumption that the benefit is higher than the cost.

The negative relationship can also be associated with the effect of the enforcement reputation as explained by Shimshack and Ward (2005). The effect of enforcement such as fines,can have a direct effect to factories which are regularly non-complying. This will perpetuate the perception of factories that regularly go against the regulations and causes the value of probability of penalty to increase if inspected again in the future. The number of inspection (N_INS) was found to be significantly different between level of compliance and negatively related at the 0.05 significant level. This means the number of inspection is more often or higher for factories that dont comply. Based on interviews with enforcement officers from the DOE, the inspection of factories with records of non-compliance at the last inspection will be a target for future inspection. This finding is in line with the results of studies by Harrington (1998), Harford (1991) and Harford and Harrington (1991). This proves that the enforcement body carries out selective inspection based on records of compliance and is among the normal practice of enforcement team in most countries because it reduces the cause of inspection and increases the compliance level amongst errant factories.

Hypothesis 2

The second study question is to test if consumer pressure (MP), community pressure (ComP), competition pressure (CP) and investor pressure (IP) are different in influencing the level of industry compliance and what is the type of relationship between this informal regulation (IR) component and compliance. The measurement of influence variable for component of IR is based on the total average score value for each question within each component using Likert scale. Based on the Shapiro-Wilks statistical normality test for the four influencers of IR including the overall average, the distribution was shown to be not a normal distribution. Therefore the Mann-Whitney test is most suitable to test the difference of influence for each IR component and Spearman's coefficient, rho, to test for type of relationship.

Table 5: Summary of Mann-Whitney Test Between Level of Compliance and Informal Regulation Pressure

		n	mean	Mann-Whitney		Spearman's rho	
				Statistic U	p-value	Statistic	p-value
MP	Non Compliant	14	2.88	101.5	.011**	.398	.009***
	Compliant	28	3.74				
ComP	Non Compliant	14	3.21	115.5	.029**	.340	.028**
	Compliant	28	3.88				
CP	Non Compliant	14	3.13	111.5	.023**	.354	.021**
	Compliant	28	3.76				
IP	Non Compliant	14	3.31	106.5	.014**	383	.012**
	Compliant	28	3.94				
I_IR	Non Compliant	14	3.13	105.0	.015**	.378	.014**
	Compliant	28	3.83				

Note: *   significant at $\alpha = 0.10$
      ** significant at $\alpha = 0.05$
      *** significant at $\alpha = 0.01$

A Mann-Whitney test indicated that the all IR components had a greater influence for complaint firm than for non compliant. The influence of overall IR (I_IR) was also significant and gave different influences dependent on the level of compliance (P<0.05). in terms of relationship, Spearman's coefficient, rho, showed that all components had a positive relationship with the level of significance compliance at least at the 0.05 significant level.

Generally, the influence score for each IR component was higher for compliant factories. For example, the score for consumer influence (MP) is 3.74 for compliant factories and 2.88 for non-compliant factories. This means the compliant factories received heavier pressure for the consumer factor compared to the non compliant factories. The situation is in line with the findings of studies by Lanoie et al (1998), Kathuria (2007) and Wu (2009).

Hypothesis 3

Hypothesis 3 was to test if the gains from illegal activities (IGAIN) was different influencing the industry level of compliance and the form of relation of this component and compliance. The Mann-Whitney test showed that IGAIN was not significantly different between compliant and non-compliant factories.

Table 6: Summary of Mann-Whitney Test Between Level of Compliance and Gain from Illegal Activities.

		n	mean	Mann-Whitney		Spearman's rho	
				Statistic U	p-value	Statistic	p-value
IGAIN	Compliant	14	4.7	142	.146	-.227	.148
	Non compliant	28	5.5				

Note: * significant at $\alpha = 0.10$
** significant at $\alpha = 0.05$
*** significant at $\alpha = 0.01$

Hypothesis 4

The final hypothesis is to look at whether this was a relationship between factory characteristics and level of compliance. To test this hypothesis, the chi squared test is used. The factory characteristic chosen were factory effluent compliant standard (standard A or B), the state (Pulau Pinang or Kedah/Perlis), multinational status (multinational or not) and type of industry (food and beverage, textile and paper). Tests results show that effluent compliance standard had a significant relationship with compliance level at the 0.05 significance level. A higher number of factories that are subjected to standard A did not comply compared to those subjected to standard B. This indicates that the more strict requirements of standard A maded difficult to comply. Most of these factories are in the water catchment areas that is in the upstream of a river, or in areas of water uptake used for drinking purposes.

Tests show that industry type has a significant relationship with compliance level at the 0.05 signficance level. The factories in the food and baverage, and textiles were more compliant than those from the paper industry. This was due to the use of difficult to treat chemicals by the pulp and paper factories.

Table 7: Summary of Chi-Square Test Between Level of Compliance and Characteristics of Firm.

		Level of Compliance		Chi-square	p-value
		Non compliant	Compliant		
Standard under Environmental Quality	Standard A	7	4		
	Standard B	7	24	6.158	.013**
State	Kedah/Perlis	4	3		
	P.Pinang	10	5	2.143	.143
Multinational status	non Multinational	8	15		
	Multinational	6	13	0.048	0.826
Type of industry	Food & beverage	5	17		
	Textile	2	7		
	Paper & pulp	7	4	6.159	0.046**

Note: * significant at $\alpha = 0.10$
** significant at $\alpha = 0.05$
*** significant at $\alpha = 0.01$

DISCUSSION AND CONCLUSION

Premise inspection is amongst the conventional tools of enforcement to influence compliance. The number of inspection received by a factory can have a preventive effect and subsequently influence the level of compliance. The study shows the number of inspection was significantly different between compliant and non-compliant factories. The findings of this study showed a similarity with findings of Harrington (1988), Harford (1991) and Harford and Harrington (1991) on tax compliance. The study also shows the probability of inspection did not influence compliance, while the effect of actual inspection (number of inspection) had a significant relationship with compliance. It can be concluded that actual inspection influences level of compliance but the reputation of inspection failed to influence the level of compliance.

Tests also showed that probability for penalty (P_PEN) were significantly different (P<0.05) between level of compliance. Factories compliant to regulations had a lower perception of propability for penalty compared to the non-compliant factories. This negative relationship is contrast with the other studies but the situation has been explained by Downing and Kimball (1982). Factories have certain expectation towards probability for penalty and if the probability for penalty is high, the factory is more inclined to go against the regulation after weighing that the cost is lower to go against the regulations.

Tests were carried out to look at the difference in influence of components of IR that is consumer influence (MP), community influence (ComP), competitive influence (CP) and investor influence (IP) and the informal regulation influence index (I_IR) for level of compliance.

Each component differently influence the level of compliance and had a positive relationship with the level of compliance. This means that the higher the pressure of the informal regulation component, the more incline the industry is to comply. The findings are similar to past studies done by Pargal et al (1997b), Kathuria (2006) and Lanoie et al (1998). This instrument has the potential to complement or be an effective replacement tool in influencing industry behaviour and will reduce dependenceon government financial provisions.

In summary, the studies on compliance and inspection has been done quite regularly in both developed and developing countries. However, there is potential for this type of studies to be expanded further in order to evaluate. The current situation with regard to the involvement level of private citizens in the enforcement activities and thus develop a mechanism as to how private citizen involvement can be incorporated formally in the enforcement process.

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APPENDIX

Table 3: Comparison in Terms of Percentage Compliances Between DOE Annual Report And Cluster Analysis Result

State	Industry	Cluster Analysis Result		DOE Annual Report	
		Comply No. (%)	Non Comply No. (%)	State annual report	DOE annual report 2009
P.Pinang	Food & Beverage	12(67%)	6(33%)	50/84 (60%)[1] 80%[2]	
	Textile	5(56%)	4(44%)	15/17(88%)[1] 100%[2]	Food & Beverage 82% paper 92% Textile 90%
	Paper & Pulp	6(75%)	2(25%)	16/20(80%)[1] 80%[2]	
	Total	**23(66%)**	**12(34%)**	**81/121(67%)[1] 86%[2]**	
Kedah	Food & Beverage	2(67%)	1(33%)	n.a	
	Textile	1(50%)	1(50%)	n.a	
	Paper & Pulp	1(100%)	0	n.a	
	Jumlah	**4(67%)**	**2(33%)**	**99.75%[3]**	
Perlis	Food & Beverage	1(100%)	0	1(100%)[4]	
	Total	**1(100%)**	**0**	**1(100%)[4]**	
Total		**28(67%)**	**14(33%)**		

Note: [1] = DOE annual report state of P.Pinang 2009 Environmental Quality (sewage and industrial effluent) 1978
[2] = DOE annual report state of P.Pinang 2010 (industrial effluent, sewage, air and scheduled Waste).
[3] = DOE annual report state of Kedah 2010 Environmental Quality (sewage and industrial effluent) 1978
[4] = Information Officer from DOE Perlis
n.a = data not available