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The Effect of Formal and Informal Regulations on Industrial Effluents and Firm Compliance Behavior in Malaysia

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Abstract
The rapid development of the manufacturing sector has been causing industrial effluents pollution. The practice of environmental regulation in the emerging economy focused on the externalities impact of industrialization. In conjunction with the issue, this study examines the effect of formal and informal regulation on the industrial effluent act and the firm compliance behavior in Malaysia. This quantitative study uses a survey questionnaire (structured) and involved 42 factories of three industries, namely food and beverages, textiles, and paper in Penang, Kedah, and Perlis. The data were analyzed using non-parametric tests: The Chi-Square, Mann-Whitney, and Spearman's Rho. This study uses the firm behavior theory as the framework, and our non-parametric analyses showed that the traditional enforcement and fined probability could significantly affect compliance levels. We also find the market, consumer, competitor, and investor pressure positively influence firm compliance. The empirical results suggest effective enforcement of environmental regulation and the role of non-regulation must be empowered as a support mechanism for pollution control.

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1. Introduction

Industrial effluents pollution in Malaysia occurs because of the rapid development of the manufacturing sector. Since a decade ago, Malaysia's economic growth has been driven by the manufacturing industry, amounting to 23% of the gross domestic product (GDP) and 83% of the value of exports (The Eleventh Malaysia Plan). The manufacturing industry was projected to drive the economy in the Twelfth Malaysia Plan (12MP) with the shared prosperity initiative encompassing three dimensions: economic empowerment, environmental sustainability, and social re-engineering. However, although the manufacturing sector significantly contributes to economic growth, the industry has jeopardized the environment's quality, especially the water quality. The environmental quality report in 2018 revealed that the manufacturing industry contributed 55 tons per day of biochemical oxygen demand (BOD) load. In addition, water pollution contributed by the manufacturing sector has been negatively affecting the river water quality.

Department of Environment Malaysia (2019) reported the percentage of the polluted river has slightly increased from 8% in 2018 to 9% in 2019. The degradation of river water quality in terms of BOD is attributed to various sources of organic pollutants, including wastewater from industrial, domestic, and commercial activities (Department of Environment, 2014).

In order to control pollution, the government has enacted the Environmental Quality Act 1974, which is comprehensive. In addition, industrial effluent is enforceable under the Environmental Quality (Industrial Effluent) Regulation 2009. However, even though the existing regulations are deemed to be

sufficient for pollution control, the lack of coordination has resulted in no reduction in the level of pollution in Malaysia (Ali and de Oliveira, 2018; Li, Han, et al., 2016; Muyibi, Ambali and Eissa, 2008). Generally, Shimshack and Ward (2005) stated that economists typically believe that effective regulations would require continuous enforcement and a high satisfactory rate. However, enforcement of command and control regulation typically impacts the federal government's budget. For example, expenses of enforcement activities had increased from RM49.9 million in 2000 to 120.9 million in 2019 (Department of Environment, 2014).

Therefore, the factors influencing industrial compliance behavior must be genuinely understood to strengthen the government's enforcement aspect. Brunnermeier and Cohen (2003) posited that understanding industrial compliance behavior is a key to producing effective environmental protection policies. In addition to the enforcement of formal regulations, a non-regulatory alternative, better known as Informal Regulation (IR), can also act as the catalyst to the change of industrial behavior. Overall, this study's main point of interest is to examine the effectiveness of formal and informal regulations in influencing the industrial compliance behavior of manufacturing emissions.

2. Literature review

The study on the effects of conventional enforcement on industrial environmental compliance has been a debate for decades ago (Alm and Shimshack, 2014; Dasgupta et al., 2000; Earnhart, 2004; Gray and Shimshack, 2020; Qi et al., 2020; Shimshack and Ward, 2005). Magat and Viscusi (1990) are among the earliest researchers who assessed the effects of inspecting the emission of effluents made by the paper and pulp industry in the USA. They postulated that inspections could reduce the BOD load by almost 20%. Since then, this study became the pioneer of the subsequent investigations. For example, Laplante and Rilstone (1996) continued the analysis in the same industry in Canada by considering the threat of inspection to the level of compliance and the level of waste discharge. The findings showed that the inspection and threat are significantly negative towards pollution emissions. In addition, it was proven that inspections could help improve the self-reporting of effluents by factories.

Nevertheless, those findings are restricted to inspections as the only determinant of effluent emission compliance. For that reason, Gray and Deily (1996) enlarged the study by considering whether the enforcement act influences the behavior of plant compliance and vice versa and whether the decision of a firm's compliance affects the enforcement. Instead of focusing on the effluent emissions, they focused on air pollution for 41 steel mills in the USA from 1980-1989 using the Logit and Tobit regression model. Mainly, they demonstrated that the decision to comply was influenced by the degree of enforcement. In other words, the stricter the enforcement, the higher the compliance level is likely. The results also indicated that large factories were less likely to practice high compliance levels. The compliance behavior also influences the compliance level, whereby a higher compliance level leads to lesser enforcement.

In reviewing the literature, most studies on compliance with environmental regulations are made at factories or the private sector level. It is not least to say that the government-owned entities with a motive to maximize utilities such as public treatment plants would also consider the cost of improving the environmental quality (Earnhart, 2004). Although both entities are subjected to different motives, any act of compliance with the environmental quality should refer to its cost-benefit analysis.

On the other hand, Shimshack and Ward (2005) perceived that law enforcement agencies should be efficient in prevention and enforcement activities. Still, the reputation of the agency itself is also very important in influencing the industry's behavior. By utilizing a data set from the EPA panel, which includes 217 pulp and paper mills companies in the USA from 1988 to 1996, their results proved that fines reduce two-thirds of the offense and even affect other factories. Therefore, the consequence effect to the other factories is considered as the reputational effects of the agencies.

Nevertheless, these are just examples of formal regulations' effects on industry emissions behavior, while the effects of informal regulations are also undeniable. There is no specific definition of informal regulation, and most of the literature provides different definitions. Pargal and Wheeler (1996) defined it as an act of implicit fine or shadow price for environmental pollution offenses. Kathuria (2007) also conceptualized it as a potential medium for industrial pollution control through the mechanism of "disclosure of information" and "rating." In some cases, it is deemed that the impact of the informal regulation in changing the behavior of the industry is seen to be more effective when formal regulation is weak or non-existent, especially in developing countries (Hettige, et al., 1996; Pargal et al., 1997; Pargal et al., 1997a)

As identified by Goldar and Banerjee (2004), they stated that educational, political, and environmental awareness is among the crucial factors in determining the effectiveness of informal regulation. Also, it is influenced by the distribution of information, legal and political framework, media coverage, the role of NGOs, and the existing formal regulation. However, most of these factors are related to the society's income level, and it is more effective in developed countries than in developing countries. Also, according to (Pargal, Hettige, et al., 1997; Deja et al., 2018), informal regulations appear in the form of compensation claimed by the communities affected by pollution, product boycott, physical threat, and effort towards publishing news about pollution through mass media.

Hamilton (1995) studied the effect of reactions of journalists and shareholders on the published data of the Toxic Releases Inventory (TRI) by the U.S. Environmental Protection Agency (EPA) in reducing pollution. The study is based on the hypothesis that the stock market operates efficiently and reacts to the current information and expectations. By using event study methodology to measure the presence of abnormal returns on firms traded in the New York stock exchange, the findings

showed that the companies that reported on TRI data to the EPA had a significantly negative abnormal return on average. This research was done in response to disclosing information about TRI issued on the 19th of June 1989.

It was followed by Lanoie, Laplante, and Roy (1998), who also utilized the event study methodology to examine the role of the capital market as an incentive for pollution control in the United States and Canada. The study found that the capital market responds to information and proves that most pollution firms are more significantly affected. It leaves an implication for policymakers to decide on the firm's positions in the capital market based on their environmental performance. It might be relevant, especially for developing countries that usually face weak formal regulation due to a shortage of personnel, financial problems, corruption, and a weak judicial system. This situation motivates the firms to do not comply with the environmental regulations. Farlinno and Bernawati (2020) added that company characteristics have significant effect on environmental performance.

However, Hettige et al. (1996) prove that firms may still comply with the regulations even under minimal supervision and enforcement. Particularly, they explore under what circumstances the firms are likely to comply with the environmental regulations. For this purpose, the author considered the characteristics of the factories, economic consideration, and external pressure as a tool for pollution control in four countries, namely Indonesia, Thailand, India, and Bangladesh. As expected, pollution was significant yet negatively related to skills, productivity, and the efficiency of using new processing technology. Community pressure is also significant as a tool for pollution control. Furthermore, the income level of local communities and informal education is also essential to gauge the effectiveness of the regulation.

On the other hand, Gangadharan (2006) investigates the internal aspect of a firm, such as management practices, the level of technology, training and education of workers, and the regulation of informal regulation (community pressure). For example, a questionnaire survey covering 236 factories in Mexico discovered that environmental training to employees and reward increases the probability of factories in compliance. Also, as expected, community pressure significantly affects the probability of firm compliance, although its magnitude on the environmental impact is not that great.

In a more recent study, Kathuria (2006) considered the effect of the printed media coverage through the newspaper as a medium to control water pollution in India. The study utilized monthly data on water quality in four observation stations in Gujarat from January 1996 to December 2000. The number of annual articles relevant to the quality of water pollution was calculated, including the court's decisions on industrial pollution cases, which became the focus of the public. The author also considered control variables such as the average rainfall, water velocity, and chemical production index. Meanwhile, the number of supervising staffs in each district is treated as the formal regulation variable. Econometric analysis on the collected data (pool data) was analyzed and found that the local news coverage on pollution did affect the pollution level, although the effect is not instantaneous.

A study by Lengyel and Szalay, (2018) stated that changes and development concerning autonomous transport will affect the environment. CieChańska, (2018) studied the production-for inventory environment and added that production environment defines the company's strategies for the realization of the product for the client, production methods, and consequently the production model. The factors that determine the nature of the production environment are, among others, the degree of complexity of the supply chain and the preparation of production (construction, technical and documentation.

Wierzbicki and Nowodziński (2019) stated a dynamical changing business environment is important for a company to focus on adopting imitation techniques, such as a more secure method of increasing its market share, in today's dynamic business environment. Besides that Gray and Shimshack (2020) focuses mainly on the effects of Environmental Protection Agency and U.S. state activities. They found that Environmental monitoring and enforcement activities reduce future violations at the targeted firm, reduce future violations at other facilities, and reduce emissions.

Based on the discussed literature, most of the studies treated the informal and formal regulations separately. Therefore, this study tends to fill up the gap by integrating both factors in one model. Furthermore, studies concentrating on Malaysia as a subject of interest are found to be lacking. In this view, this study steps up the pursuit to further investigate the effect of formal and informal regulations towards industrial effluents regulation compliance. For this purpose, the Becker model (1968) of criminal utility is employed in this study to understand the behavior of a firm's compliance which is subject to fewer studies in the literature. Therefore, by utilizing the model, the study further fills the gap in the literature.

3. Materials and Methods

For this study, the model developed by Becker (1968) was adopted. It is mainly due to its suitability with the objective and assumption in this study which views that the industry is rational in making decisions based on cost-benefit analysis. The model is also in line with the theory of firm behavior. The basic Becker's individual utility states that any activities that tend to violate the EU laws are subjected to the financial returns (Y), the probability of being detained (p), and the expected financial penalties (F).

$$EU = (1 - p)U(Y) + pU(Y - F) \quad (1)$$

From the equation, EU is the total utility gained by abiding by the law, and U is the utility for each criminal activity. Individuals tend to break regulations when the returns of illegal activities (Y) exceed the expectations of financial penalties upon the violation of regulations. Meanwhile, it complies with the regulations when the EU is negative. Negative EU is produced if the expected financial penalties are greater than the expected financial returns from criminal activities (F > Y).

The theoretical framework used to explain the factors influencing industrial compliance behavior upon the environmental quality is shown in Figure 1. The firm is assumed to be rational in decision-making based on the cost-benefit analysis

and the environmental value. The compliance factors that affect the behavior are (i) the number of inspections, (ii) the event of fines, (iii) the probability of inspections, (iv) the probability of fines, (v) the gain from illegal activities, and (vi) informal regulations. The item (i) until (iv) represents the formal regulation of the authorities, while the informal regulation variable is described by four pressures, as stated in Fig. 1.

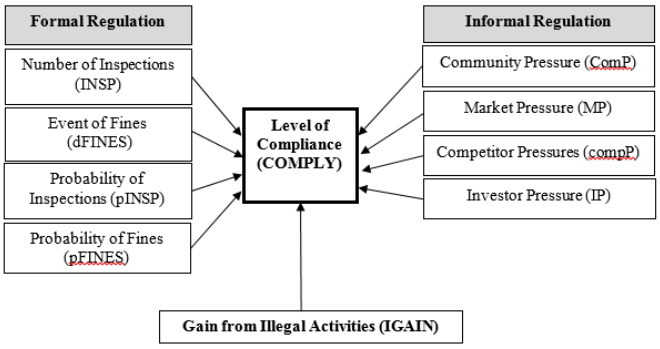

Fig. 1. Theoretical Framework

3.1. Data Source and Collections

The primary source of the research data is a structured questionnaire. The study only considers the compliance behavior of three industries (food and beverages, textiles, and paper) subjected to the Environmental Quality (Industrial Effluent) Regulation 2009 in three states, namely Penang, Kedah, and Perlis. Therefore, there are 72 factories identified, and a census was used to obtain at least 30% of the study sample. Neuman (2003) stated that a 30% sample size is sufficient for a less-than-1000 population.

3.2. Variable and Measurement

In this study's the main variable of interest is the compliance level of firms in abiding by the environmental law (COMPLY). Determining the level of firm compliance with the effluent emission regulations is based on self-assessment (self-assessed) towards five questions. The factories should state the priority of each factor in promoting effluent management for the past five years. Five Likert scale is used, i.e. "1 = not being prioritized" to "5 = highly being prioritized". Next, the determination of compliance level for each factor is determined using cluster analysis based on the answers given. Everitt (2002) stated that cluster analysis is a method to build an informed and proper classification of a data set that is not originally classified using the variables of each individual.

The premises asked direct questions about the event of fines (dFINES) or notice given in the form of court action by the DOE upon failure to comply with the regulations of effluent emissions during the past 12 months. This dragonfly-shaped variable had a binary value of "1" for Yes (being fined) and "0" for No. In addition, the factories were also directly asked about the number of inspections (INSP) received within the last 12 months.

Next, the 'probability of inspections' (pINSP) variable, the management was questioned about their perceptions of the probability of being examined within the next 12 months. The binary dependent variable was coded "0" for the probability of low inspection and "1" for high inspection. The average value of inspection probability used as a benchmark, such as value under average, the probability to be examined was categorized as low. For the value above average, the probability to be examined was categorized as high. Finally, to measure the probability of fines (pFINES), the management was asked about their perception of a possible fine upon receiving an inspection visit in the last 12 months. Again, the binary dependent variable used the code of "0" for the probability of fines below average and code "1" for the probability of being examined above average.

On the other hand, this study employed the size of operational cost percentage and the maintenance of the effluent treatment system per month to proxy the gain from illegal activity (IGAIN). The expected relationship between compliance with operational and maintenance costs is negative, whereby factories with high operating costs of effluent treatment tend to disobey the regulations. Wu (2009) gave a clear description to form the Informal Regulation (IR) variable. The IR is formed based on four types of pressure; community pressure (CompP), competitor pressure (CP), investor pressure (IP), and market pressure (MP). In the questionnaire, the firms will be asked to determine the stress level of each factor influencing the environmental management of factories in the last five years. Five (5) point Likert scale was used to describe the degree of influence of each factor (1 = no influence, to 5 = strongly influence).

3.3. Method of Data Analysis

Based on the theoretical framework (Fig. 1), the research hypothesis examined the relationship between the independent variables and the compliance level. Therefore, the selection of analytical tools should consider the level and form of distribution of the variables. A parametric test would require a normally distributed variable assumption (hose-shaped), and if this assumption is not met, then the non-parametric test is more suitable (De Vaus & de Vaus, 2013). Thus, the normality tests on variable intervals, namely INPS, pFINES, pINSP, IGAIN, and all informal regulation variables, are needed to determine the test instrument. Meanwhile, the chi-square test and spearman's rho were used to test the relationship between the nominal variable dINSP and COMPLY.

4. Results and Discussion

In the first section, we reported the result of survey response rate by industry and state. It aims to ensure the number of factories that participated is sufficient.

Table 1 shows that the pulp and paper industry has given high cooperation in terms of involvement with the questionnaire (64.7%), followed by the textiles industry (60%) and the food and beverages industry (55%).

Table 1. Result of Response Rates by Industry and State

	Response							
Industry/State	Penang		Kedah		Perlis		Total	
	n/N	%	n/N	%	n/N	%	n/N	%
Food and Beverages	18/30	60	3/9	33.3	1/1	100	22/40	55
Textiles	8/14	57.1	1/1	100	-	-	9/15	60
Pulp and Paper	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

Responses in Penang recorded the highest rate (59.3%), followed by Kedah (50%). Although the responses in Perlis recorded a 100% rate, the population size is relatively small (1.4%) compared to Penang (81.9%). Nevertheless, the data represent 58.3% of the study population (72 factories), and these rates exceed Neuman's (2003) recommendation.

4.1. Industrial Profiling

Table 2 summarizes the data distribution based on the firm's criteria such as type of industry, number of employees, annual sales, ownership, company status, age of the senior management staff, and number of permanent employees. Out of 42 cooperatives, 52.4% are in the food and beverages industry, followed by the pulp and paper industry (26.2%). A total of 42.9% of the questionnaires were answered by the assistant managers and 21.4% by the managers. Meanwhile, 7.1% were responded to by the safety and health managers, who have comprehensive knowledge about the management aspect of waste effluent. The remaining balance of 28.6% was answered by the executive-level staff such as supervisors, human resource executives, engineers, production executives, and safety and health executives.

Table 2. Profile of Industry with Subject to Environmental Quality (Industrial Effluent) Regulation 2009

No.	Firm Characteristics	Frequency	Percentage
1	**Type of Industry:**		
	Food and Beverages	22	52.4
	Textiles	9	21.4
	Pulp and Paper	11	26.2
2	**Position of Respondents:**		
	Manager	9	21.4
	Assistant manager	18	42.9
	Manager Health and Safety	3	7.1
	Others	12	28.6
3	**Industrial Zone:**		
	Yes	33	78.6
4	Age of Building (Years)	31.6 (Average)	
5	**Ownership:**		
	Local	38	90.5
6	**Status of Company:**		
	Multinational Company	19	45.2
7	**Age Distribution of Top Management:**		
	31-40	4	9.5
	41-50	14	33.3
	51-60	15	35.7
	61 and Above	9	21.4

4.4. Hypothesis Testing

The first hypothesis was to observe the effects of different formal regulations in influencing industrial compliance and discover the type of relationship. There are two conventional inspection tools, namely enforcement, and penalty, which have been proven to influence compliance, as most literature has been elucidated. Therefore, both variables, the numbers of actual inspections received by the industry (INSP) and the fined (dFINES), were utilized to evaluate the real impacts of enforcement upon the compliance action. Meanwhile, the other two variables, the probability of inspections (pINSP) and the probability of fines (pFINES), describe the industrial perception of the authorities.

The Shapiro-Wilks normality test suggests that out of four variables, three variables (INSP, pINSP, and fines) were not normally distributed. Therefore, a non-parametric statistical test using the Mann-Whitney method seemed more suitable and compared the two independent samples, while Spearman's rho coefficient checks for the relationship among the variables. On the one hand, the Chi-square test was employed to test the relationship between dFINES and COMPLY.

The Mann-Whitney test showed no significant difference in the probability of being fined between the compliant factories and the non-compliant factories at a 0.01 significance level (Table 3). Other than that, the correlation coefficient of Spearman's rho illustrated that both variables are negatively related and significant at a 0.01 significance level. It means that the expected probability of being fined is higher for non-compliant factories (0.29) compared to compliant factories (0.08). Therefore, the lower the compliance level, the higher the probability of being fine.

Table 3. The Result of Probability of Fines, Probability of Inspections, and Number of Inspections against the Compliance Level

	COMPLY	n	Average	Mann-Whitney		Spearman's Rho	
				Statistic	Asymp. Sig. (2-tailed)	Statistic	Sig. (2-tailed)
pFINES	Comply	14	0.08	96.5	0.004***	-0.455	0.002***
	Not Comply	28	0.29				
pINSP	Comply	14	0.65	158	0.304	0.16	0.31
	Not Comply	28	0.56				
	Comply	14	1.07	110	0.013**	-0.387	0.011**
INSP	Not Comply	28	1.79				

Note: * Significant at 0.10, ** Significant at 0.05 and *** Significant at 0.01

Merkhofer (2012) explained this situation by stating that the compliance decision is based on cost-benefit analysis. The industry can somehow expect the probability of its premises being fined based on the compliance history. In this case, the industry is willing to breach the regulations to the extent of

being threatened with an exorbitant fine, assuming that the violation act generates higher returns and benefits than the costs or probability of being fined (Wierzbicki and Nowodziński, 2019). This negative relationship can also be associated with the effect of reputational enforcement, as described by Shimshack and Ward (2005) and Maor and Sulitzeanu-Kenan (2013). The effects of enforcement, such as acceptable charges, can directly impact the factories that are often non-compliant. It maintains the perception that factories that frequently violate the laws will probably face higher charges if they are not inspected.

The number of inspections (INSP) variable was also significantly different and negatively related to the compliance level at 0.05 significance level. It means that the number of inspections is more frequent for non-compliant factories. According to the interviews with law enforcement officials, factories with non-compliant records will be the prime target for inspections in the future. It is in line with the findings discovered by Harrington, (1988), Harford (1991), Harford and Harrington (1991), Aikins (2011) and Grbić, Ivanišević and Čulin (2015) who prove that the authorities conduct inspections by relying on the compliance record. In addition, Distelhorst, Hainmueller and Locke (2017) said that it is a common practice in most countries to reduce enforcement expenses and increase compliance for non-compliant factories.

The Chi-square test for the event is being fined (dFINES) against the compliance level (COMPLY) was found to be significant at 0.05 significance level. Furthermore, the correlation coefficient of Spearman's rho also showed a significantly negative correlation with a 0.05 significance level (Table 4). It means that the non-compliant factories are more inclined to be penalized compared to the compliant factories. Similar findings are reported by (Joosen and Zhelyazkova, 2021; Stoimenova et al., 2020).

Table 4. The Result of Event of Fines against the Compliance Level

COMPLY	Event of fines (dFINES)		χ^2	p-value	Spearman	p-value
	No	Yes				
Not comply	6	8	5.357	0.021*	-0.357	0.02*
	-9.3	-4.7				
Comply	22	6				
	-18.7	-9.3				

Note: * Significant at 0.10, ** Significant at 0.05 and *** Significant at 0.01

The second hypothesis in this study was to test whether the Informal Regulation (IR) such as community pressure (CompP), competitor pressure (CP), investor pressure (IP), and market pressure (MP) would differ in the degree of influencing the industrial compliance and their relationship. The effect of variable size in affecting each IR component is based on the total values of the average score for each question and is measured using the Likert scale. However, according to the Shapiro-Wilks statistical normality test for the four components of informal regulations, the total average for the entire variables is not normally distributed. Therefore, the Mann-Whitney test is deemed the most suitable method to test for the effects of each IR component. Spearman's rho coefficient is used to test the relationship between the variables. Mann-Whitney test in Table 5 shows that all components of the IR differed significantly in influencing the compliance level at 0.05 significance level. In terms of the relationship, the coefficient of Spearman's rho illustrated that all components were significant and positively connected with the compliance level at least at 0.05 significance level.

The influence score for each component of IR was higher for compliant factories. For example, the user score (MP) was 3.74 for compliant factories compared to 2.88 for non-compliant factories. It means that the compliant factories received more robust consumer pressure than non-compliant ones. This finding is in line with Lanoie et al. (1998), Kathuria (2006), Wu (2009), (Jiang, 2009), and (Huq et al., 2014).

Table 5. The Result of Formal Regulation against the Level of Compliance

Variable/ COMPLY		n	Average	Mann-Whitney		Spearman's Rho	
				Statistic	Asymp. Sig. (2-tailed)	Statistic	Sig. (2-tailed)
MP	Not comply	14	2.88	101.5	0.011**	0.398	0.009***
	Comply	28	3.74				
ComP	Not comply	14	3.21	115.5	0.029**	0.34	0.028**
	Comply	28	3.88				
CompP	Not comply	14	3.13	111.5	0.023**	0.354	0.021**
	Comply	28	3.76				
IP	Not comply	14	3.31	106.5	0.014**	0.383	0.012**
	Comply	28	3.94				
IR	Not comply	14	3.13	105	0.015**	0.378	0.014**
	Comply	28	3.83				

Note: * Significant at 0.10, ** Significant at 0.05 and *** Significant at 0.01

The following hypothesis was to test whether there are differences in the illegal gain (IGAIN) between the compliant and non-compliant factories. The monthly percentage of operational and maintenance costs of the effluent treatment system was used as a proxy for the benefits of factories in the event

of breaking the regulations. Unfortunately, the Shapiro-Wilks statistical normality test was not normally distributed. The Mann-Whitney test was therefore applied. As a result, the effluent treatment system's operational and maintenance costs significantly differed between the non-compliant factories (6:43%) and compliant factories (3.32%). The Spearman's rho correlation coefficient was also negative and significantly related between the two variables at 0.05 significance level.

Table 6. The Result of Gain from Illegal Activities (IGAIN) against the Compliance Level

Variable/ COMPLY		n	Average	Mann-Whitney		Spearman's Rho	
				Statistic	Asymp. Sig. (2-tailed)	Statistic	Sig. (2-tailed)
IGAIN	Not comply	14	6.43	61.5	0.000***	-0.568	0.000***
	Comply	28	3.32				

Note: * Significant at 0.10, ** Significant at 0.05 and *** Significant at 0.01

Table 6 indicates that the higher the operational and maintenance costs of factories, the higher the probability of the factories breaking the regulations. The revenues generated from illegal activities may allow factories for higher cost-saving in factories breaking the regulations. The study findings proved that the industry is likely to violate the effluent regulations when the operational and maintenance costs of IETS increase to a certain level. These findings are consistent with previous studies such as Kuperan and Sutinen (1998), Jamal (2004) and Shimshack and Ward (2005)

5. Summary and Conclusion

Formal regulations through the enforcement of environmental regulatory quality are proven to influence compliance behavior. The study also posited that firms that are unlikely to comply with the regulations would experience frequent visits from the industrial authority. However, frequent inspections will taint the image of authority in the eyes of the industrial players. Meanwhile, fines or penalties for breaking the regulations significantly affect the compliance activities and impact the authority. Finally, Informal Regulations (IR) such as market pressure, community, competition, and investors may add pressure on firms in effluent management and subsequently affect the compliance level. Therefore, the role of Informal Regulations (IR) is seen as complementary to the effectiveness of formal regulations to change industrial compliance behavior.

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正式和非正式法规对马来西亚工业废水和企业合规行为的影响

關鍵詞
环保合规
工业废水
正式监管
非正式监管
合规行为

摘要
制造业的快速发展造成了工业废水污染。新兴经济体的环境规制实践侧重于工业化的外部性影响。结合这个问题，本研究考察了正式和非正式监管对马来西亚工业废水法和企业合规行为的影响。这项定量研究使用调查问卷（结构化）并涉及三个行业的 42 家工厂，即槟城、吉打和玻璃市的食品和饮料、纺织和造纸。使用非参数检验分析数据：卡方检验、Mann-Whitney 检验和 Spearman 的 Rho。本研究以企业行为理论为框架，我们的非参数分析表明，传统的执法和罚款概率会显着影响合规水平。我们还发现市场、消费者、竞争对手和投资者的压力对公司合规性产生积极影响。实证结果表明，环境监管的有效执行和非监管的作用必须被赋予作为污染控制的支持机制。