

Major Factors Affecting Industrial Hazardous Waste policy Implementation in Central Thailand

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1. Introduction

Rapidly increasing health costs and ecological system deterioration due to poorly managed hazardous wastes are two of the most important public policy issues to emerge recently in Thailand. In fact, environmental problems are rapidly increasing as Thailand rushes to industrialize. Although the relationship between industrialization and environmental degradation is generally well understood by academics and administrators, preventive measures are yet not widely practiced, and environmental management is perceived to be the sole responsibility of the Thai government. Indeed, the efforts made by a series of Thai governments have produced unsatisfactory results, mainly due to lack of political will necessary to properly implement existing environmental policy and to the ineffective policing of existing regulations. These shortcomings have and are both contributing significantly to the deterioration of public health standards and the degradation of local ecological systems. Moreover, they also seem certain to impose significant long-term burdens on both current and future generations of Thai citizens.

Public health is often the primary causality of environmental degradation in a rapidly industrializing economy such as Thailand's. This usually shows up as growth in the number of illnesses caused by pollution of the environment. In fact,

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the number of public hospital visits resulting from exposure to industrial toxins grew at an average annual rate of 8.12 percent in Thailand during the period 1984-1996 (Ministry of Public Health, 1993; Pollution Control Department, 1996a). Meanwhile, reports from the Pollution Control Department, the Department of Industrial Works, the Department of Health, and the Bangkok Metropolitan Authority confirm that public complaints about hazardous waste have increased significantly, from only 3.37 percent in 1992 to 15.96 percent in 1995 (Ministry of Public Health, 1993; Pollution Control Department, 1996a). This alarming growth in complaint reflects the growing public awareness of environmental problems, the increasing generation and accumulation of hazardous waste, and the failure of a succession of Thai governments to properly address this issue.

The accumulation of toxic residues from industrial wastes in water, air or soil can lead to the disruption (and sometimes the destruction) of local food chains, fresh water supplies and breathable air. Toxic substances known to be often released into the environment include heavy metals, wastes from plastics and electronics factories, oils and lubricants, alkalis, acids, and chemical solvents. Their release often damages the flora and fauna that form vital parts of the food chain for human beings (Stoan, 1993: 42). Furthermore, breathing polluted air adversely affects the human respiratory system, circulatory system and other body systems which results in high instances of skin irritation and eye problems - and can even lead to blindness and terminal diseases such as cancer (Cohrssen Environmental Inc., 1992: 3-1, 3-2).

In total, these side effects constitute one of the worst 'adverse impacts' of the industrialization process. For instance, water pollution often has particularly serious negative consequences for humans, animals, plants and indeed the entire ecosystem (The Office of Scientific Affairs, 1993: 7). Moreover, faced with government indifference and the absence of proper environmental management, we can only guess as to how many more deaths and illnesses will occur before our elected representatives and the government bureaucracy begin to demonstrate the

degree of genuine resolve and strong, ongoing policy commitment that is required if we are to seriously address Thailand's alarming level of environmental degradation and pollution. The main issue examined in this dissertation is how well Thai governments have dealt with the problem of hazardous waste generation as a negative impact of very rapid industrialization and resource exploitation. This paper intends to reach a true understanding of how Thai government agencies have acted and reacted in relation to environmental issues, as well as their methods of approach and their style of management in relation to this issue.

2. Hazardous Waste: Thailand Study

Hazardous waste is produced by many local industries (Pollution Control Department, 1993b), for instance, electrical circuit board production and electroplating require heavy metal coating processes during production which produce residues such as lead, cadmium and mercury. Similarly, leather tanning involves the use of strong acids and alkalis, heavy metals and flammable substances, while the manufacture and processing of textiles produces heavy metals and solvent dyes (Scanlon, 1987: 67).

Hazardous waste generation is also usually concentrated in heavily industrialized areas. In 1993, The Thailand Environment Institute (Phantumvanit, et al., 1994) reported that a total of 33,709 factories were located in just 10 of Thailand's 76 provinces: Bangkok, Samut Prakarn, Samut Sakorn, Ratchaburi, Rayong, Prathum Thani, Chonburi, Chacheongsao, Nakorn Pathom, and Nonthaburi. These 10 provinces were responsible for producing approximately 90 percent of Thailand's entire hazardous waste, about half of which consisted of heavy metal residues (Phantumvanit, et al., 1994; Pollution Control Department, 1993b). Furthermore, all of these provinces are either near or adjacent to Bangkok.

Meanwhile, a succession of Thai governments has publicly acknowledged the importance of managing hazardous wastes responsibly. Since the implementation of Thailand's 2nd National Economic Development Plan in 1968,

these governments have both implemented numerous environmental protection policies and also assigned responsibilities in this regard to various public agencies. The centerpiece of their environment management efforts has been the development of regulatory systems containing voluntary practice guidelines, incentives and penalties. For instance, the Poisonous Substance Act, 1967 (first amended in 1973) was aimed at controlling the import and export, manufacture, storage, marketing, transport, sale and use of toxic substances. Under this Act, poisonous substances are broadly defined as 'active ingredients'. Similarly, Thailand's first environmental law (The Factory Act, 1969) prescribed regulations relating to manufacturing processes.

However, despite these efforts, the environment has never really been a top priority issue for any Thai government because they have all chose to be overwhelmingly preoccupied with the task of industrializing and otherwise 'modernizing' the country. Nevertheless, the Factory Act did amount to an official recognition of and at least partial response to the environmental problems resulting from manufacturing processes. The Act not only provided the first legal framework for regulating the processes and outputs of the industrial sector, it also made the Department of Industrial Works (of the Ministry of Industry) responsible for managing industrial safety and industrial pollution, and gave it control over the establishment and operation of factories (via mandatory factory licensing at five year intervals - Department of Industrial Works, 1992: 6), the setting and enforcing of industry standards, the monitoring of waste water management and hazardous waste management, and the establishment of centralized waste water and hazardous waste treatment facilities (DIW brochure; MESA, 1995; Factory Act - 1992).

The National Environmental Quality Act (NEQA) of 1975 represented Thailand's first official policy commitment to environmental management (since amended in 1978 and 1992 and renamed the Enhancement and Conservation of National Environmental Quality Act). The original 1975 Act introduced both a

master plan for environmentally safe industrial practice and established incentives and penalties for various industries and offenders. The Act also established the Office of National Environmental Board (NEB), making it the official national authority on environmental issues. The Board was also set specific tasks, such as prescribing environmental standards, developing and monitoring emission standards, and developing a practical framework of cooperation with other agencies such as the Ministry of Industry, the Ministry of Interior, the Ministry of Science, Technology and Environment, the Ministry of Public Health, the Ministry of Finance and the Office of the Prime Minister.

- The dominant feature of NEQA 1975 was the introduction of Environmental Impact Assessment (EIA) as a prerequisite for the granting of operating licenses for specific industrial activities. An amendment to the Act in 1992 introduced the 'polluter pays' principle as well as providing additional incentives for environmental protection efforts, such as tax concessions on imported environmental protection equipment (Pollution Control Department, 1994a: 5-6; Department of Environmental Quality Promotion, 1994: 5-6, 29). Specifically, these incentives provided for substantial or full exemption from the prevailing 50 percent import tax on industrial machinery. Meanwhile, 'polluter-pays' legislation introduced a new penalty system for violators which made polluters responsible for all clean-up costs.

Also revised in 1992 was the Factory Act. Various amendments made the Ministry of Industry also an enforcement agency, giving it the authority to monitor and inspect both pollution prevention and environmental management activities, and to revoke or suspend operating licenses. They also made the Ministry responsible for certifying private sector inspection of factories and industry responsible for reporting to ministry officials (Department of Industrial Works, 1992). However, so far there have been only two central treatment plants set up, (a private contractor runs one, and one is private company).

The relationship between the NEQA and Factory Act is largely determined by their roles and expectations. While the NEQA has delegated its authority with regard to policy planning and coordination to the NEB, the Factory Act still designates the Ministry of Industry as the policy enforcement agency. In effect, this has allowed each agency to remain largely autonomous in the exercise of its duties, despite the fact that such autonomy runs counter both to the principles and the realities of proper environmental policy implementation - which require a high degree of responsiveness and coordination. Thus, differences between the role expectations and the actual roles of these two agencies consequently became a major obstacle to successful environmental policy implementation, and because of this these policies will be discussed in more detail in the next chapter.

Many separate organizations are involved in the planning and implementation of environmental conservation and industrial hazardous waste management policies. In fact, currently there are at least five ministries, four departments and seven agencies directly involved in hazardous waste management policy. In addition, each of these organizations has its own duties, regulations and area of jurisdiction.

As mentioned earlier, the management of public policy in relation to hazardous waste was chosen as the primary topic of investigation for this dissertation largely due to the alarming growth of hazardous waste production in Thailand. Coupled with the glaringly obvious lack of proper hazardous waste management, this has led to deep public dismay about feeble governmental efforts to protect Thailand's environment, for although numerous laws have been passed there are evidently certain problems which prevent the effective implementation of proper hazardous waste management policy. The two most serious of these are the previously cited lack of coordination between implementing agencies and the general lack of coherence, consistency and comprehensiveness in both policy development and policy implementation. The intractability of these and other

problems has only served to prolong the malaise of inadequate policy development and ineffective policy implementation.

Moreover, despite the glaring need for a proper empirical study of industrial hazardous waste policy in Thailand, until now no such study has been made. Indeed this dissertation is the first-ever-local study of this kind.

This study contains two basic objectives: 1) to identify the major determinants of environmental policy implementation effectiveness, and 2) to identify the major determinants of effective environmental policy compliance. These two factors, together with the level of external support which is available, are generally recognized as the three major factors which determine effectiveness of policy implementation, and indeed nearly all of Thailand's environmental problems arise from discrepancies between public policy and policy implementation.

It is generally accepted that enforcement of national policy and monitoring of private sector compliance are related to the prevailing behavior of the parties concerned. Indeed, the term 'national policy' implies central government authority over local authorities. Thus any conflict between planners and agents implies a lack of coordination between policy makers and policy implementers, illustrating the discontinuities which can and do occur between public policy and policy actors (i.e. implementors) at both the micro and macro level.

This study examines hazardous waste management in the central region of Thailand in order to identify the nature of the obstacles to proper environmental management, because although hazardous waste management is only one aspect of environmental policy it is arguably the most alarming of Thailand's present environmental problems. Industrial residues such as heavy metals, toxic chemicals, and the hazardous wastes that pollute the environment (i.e. water, air, and land) often, lead to acute or chronic health problems as well as causing serious harm to the environment itself. Fortunately, effective hazardous waste management is

achievable: both local and overseas experiences confirm that properly treated hazardous waste can be stored safely or successfully recycled for further use.

Thailand's central region, which includes the greater Bangkok metropolis, was chosen for this study because it is where over half of Thailand's manufacturing industries are located and also because a focus on pollution from heavy industry seemed able to provide a clearer and more direct understanding of the hazardous waste problem.

3. Approaches

This study used a non-experimental approach, relying rather on the collection and analysis of existing data. As no single method was able to provide satisfactory answers to the research questions posed in this study, the use of multiple measurement techniques and various qualitative and quantitative data collection methods were required. Moreover, this approach has provided sufficient data from the various research methodologies employed to enable systematic cross-checking of results. Measurement is defined herein as the process of transforming abstract data into concrete variables. Independent and dependent variables were operationalized so that they could be measured empirically.

The data of this study was obtained from government officials and from factory managers. The government sector sample consisted of 98 officials drawn from the Pollution Control Department (PCD) and the Department of Industrial Works (DIW). In the industrial sector, 104 type 3 factories (i.e. those having the potential to generate hazardous waste according to the DIW) from ten provinces in the central region of Thailand (Bangkok, Samut Prakarn, Samut Sakorn, Ratchaburi, Rayong, Pratum Thani, Chonburi, Chachoengsao, Nakorn Pathom, and Nonthaburi) were surveyed, as approximately 90 percent of Thailand's total hazardous waste was generated by factories in this region. As for data collection, one set of questionnaires was distributed to government officials at the DIW and

the PCD, while a second set of questionnaires was sent to industrial sector owners or managers as indicated above.

To complement this process, in-depth interview and participant observation techniques were employed in order to uncover information that could not or might not be obtained via the questionnaires. This involved in-depth interviews with government officials and industry owners in order to clarify the findings of quantitative data analysis. Participant observations were also conducted in order to help clarify and expand upon the extent to which the industrial sector understood and complied with government policy of that time.

The data obtained was then analyzed using statistical and qualitative analysis techniques. Next, the conceptual model was tested to see whether the initial hypotheses should be accepted or rejected. During this stage, factor analysis and alpha analysis were utilized to extract factor variables, after which some variables were discarded while others were re-grouped to form new variables. The independent variables used in hypothesis testing were then replaced with these new variables.

This study sets out three hypotheses:

Hypothesis I. The implementation of effective industrial hazardous waste policy requires both proper policy enforcement and proper policy compliance, which in turn depends on two factors: implementing agency capacity and private sector willingness to comply with policy.

Hypothesis II. Implementing agency capacity is determined by eight major factors: 1) government policy, 2) effective leadership, 3) technical staff ability, 4) implementing agency capacity, 5) public concern about the waste management problem, 6) the provision of fringe benefits to policy implementors, 7) government and agency leaders' policy commitment, and 8) policy resources.

Hypothesis III. The industrial sector's willingness to comply with policy is influenced by three major factors: 1) its environmental awareness, 2) its environmental conservation expenses, and 3) its environmental conservation incentives.

4. Results

4.1 Factors Affecting Policy Enforcement

Hypothesis I states that policy enforcement depends on implementing agency capacity. The results of testing this hypothesis are reported in this section. Initially, the relationship between policy enforcement and implementing agency capacity was computed using correlational analysis (Harris, 1995: 203-211). However, it was found that the Pearson product moment correlation yielded no statistically significant relationship between these two variables.

Since the initial analysis failed to reveal any linear relationship between policy enforcement and implementing agency capacity, the 'curve estimation' technique was then employed to determine which model most closely described the relationship between these two variables (SPSS, Inc., 1997: 242). Of the various models tested, it was discovered that the best fit was achieved by quadratic equation form.

The structural equation for policy enforcement is therefore best expressed in the form of the following quadratic equation:

$$\text{PENF} = b_2\text{IAC}^2 + b_1\text{IAC} + b_0 + e \dots\dots\dots(1)$$

The results of this analysis are summarized in Table 1 and Figure 1.

Table 1 Regression Model for Policy Enforcement and Implementing Agency Capacity

Predictor		Regression Coefficient	T-value
Implementing Agency Capacity (IAC)	IAC	.154389*	2.283
	IAC ²	-.000716	-.574
		r = .885	
		R ² = .783	
		Adjusted R ² = .777	

Note: *p < .05

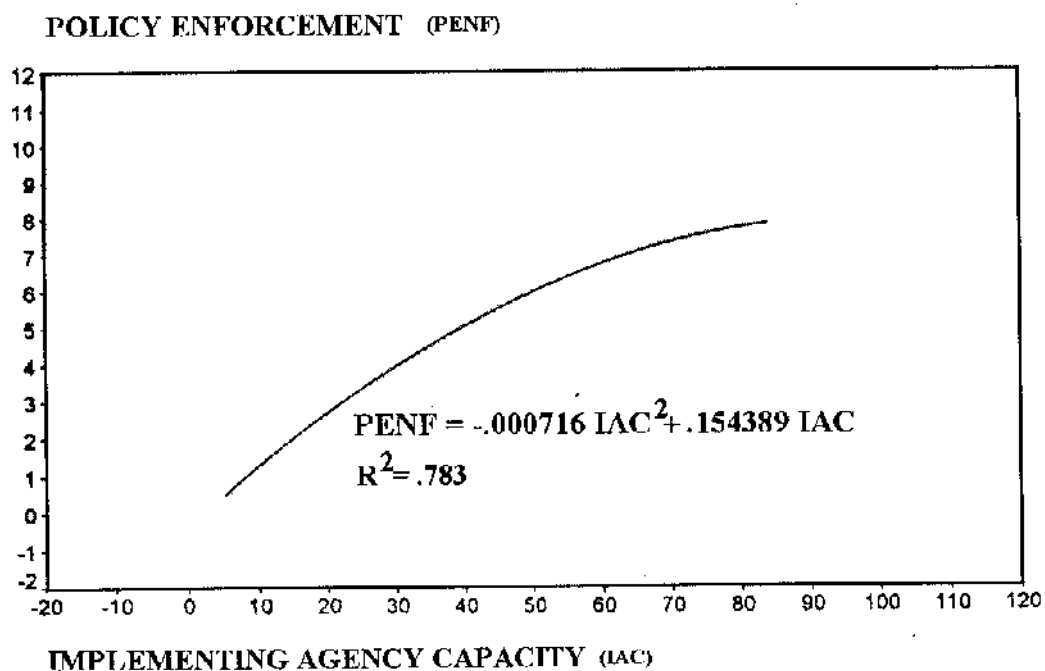


Figure 1 Relationship between Implementing Agency Capacity and Policy Enforcement

Table 1 and Figure 1 show that implementing agency capacity has a non-linear relationship to policy enforcement, and on this basis the first part of Hypothesis I (*re* policy enforcement) can be accepted. The quadratic curve in Figure 1 indicates that although government officials' level of enforcement increases as implementing agency capacity increases, there is a maximum enforcement level or ceiling which is determined by existing laws and regulations.

In addition to quantitative analysis, in-depth interviews and participant observations were employed in order to provide additional information.

4.2 Factors Affecting Degree of Compliance

As with the study of factors affecting policy enforcement, a Pearson product moment correlation was first computed to test the relationship between the industrial sector's willingness to comply and its degree of compliance. The result showed that these two variables in fact had a very low linear correlation. Therefore, curve estimation was employed to determine the relationship between the industrial sector's willingness to comply with policy and its degree of compliance. The results of this analysis indicated that a quadratic equation would best describe the model. The structural equation of degree of compliance is best expressed in the form of following quadratic equation:

$$DCOMPLY = b_2 WCOMPLY^2 + b_1 WCOMPLY + b_0 + e \dots\dots(2)$$

Table 2 and Figure 2 show that willingness to comply with policy has a non-linear relationship to the industrial sector's degree of compliance. Thus this data provides empirical support for the second part of Hypothesis I, which concerns the relationship between willingness to comply and degree of compliance. However, although degree of compliance with policy increases as the industrial sector's willingness to comply increases, it cannot exceed the maximum

compliance level or ceiling which is determined by existing laws and regulations, as was also shown to be the case for Part I of Hypothesis I.

Table 2 Regression Model for Degree of Compliance

Predictor		Regression Coefficient	T-value
The Industrial Sector's Willingness to Comply (WCOMPLY)	WCOMPLY	1.181068*	3.117
	WCOMPLY ²	-.006740	-.855
		r = .912	
		R ² = .831	
		Adjusted R ² = .827	

Note: *p < .005

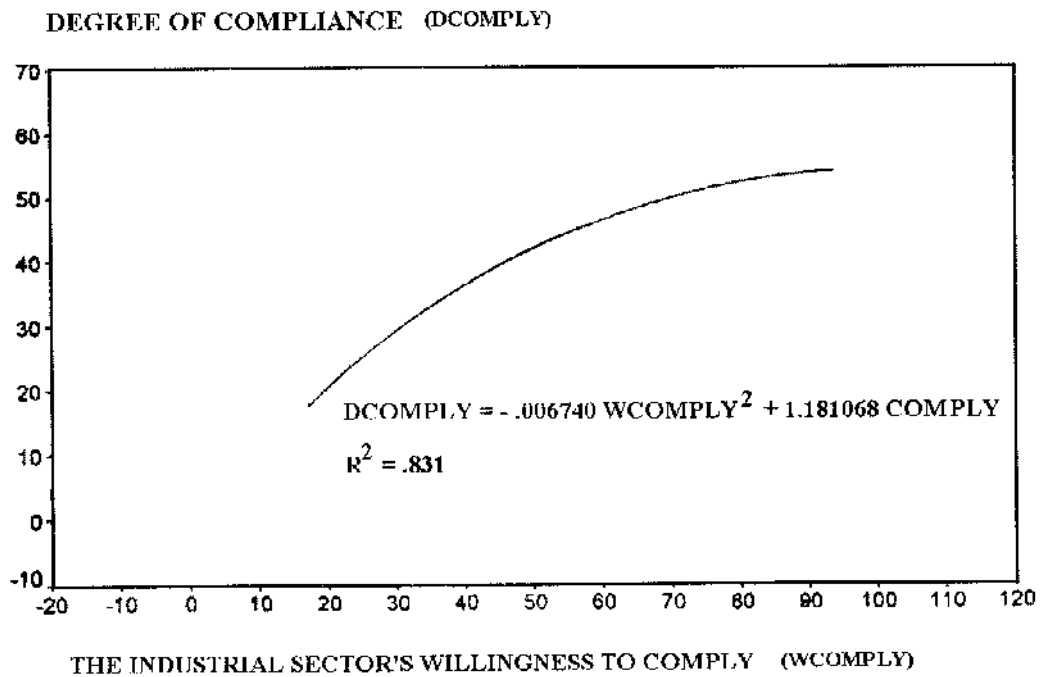


Figure 2 Relationship between the Industrial Sector's Willingness to Comply and Degree of Compliance

4.3 Factors Affecting Implementing Agency Capacity

This section tests the hypothesis that the following eight variables affect implementing agency capacity: 1) government policy, 2) effective leadership, 3) technical staff ability, 4) implementing agency incentives, 5) public concern about the waste management problem, 6) provision of fringe benefits, 7) government and agency leaders' policy commitment, and 8) policy resources. Multiple regression analysis was employed to test the research hypothesis that implementing agency capacity is determined by these eight variables.

The structural equation for this model can be expressed as:

$$\text{IAC} = b_0 + b_1\text{POLICY} + b_2\text{LEAD} + b_3\text{TSTAFF} + b_4\text{INC} + b_5\text{PCW} + b_6\text{PFB} + b_7\text{COMMIT} + b_8\text{RES} + e \dots\dots\dots(3)$$

The results of this data analysis are shown in Table 3. The set of eight variables was found to explain 39.1 percent of variation in implementing agency capacity values. However, only five of these variables exhibited a statistically significant relationship with implementing agency capacity: 1) government policy, 2) effective leadership, 3) technical staff ability, 4) implementing agency incentives, and 5) public concern about the waste management problem. Accordingly, the following three variables were removed: 1) provision of fringe benefits, 2) government and agency leaders' policy commitment, and 3) policy resources. In effect, the remaining five variables can be said to account for nearly all of the variation described by the initial group of eight variables. This is because there was a significant degree of overlap in the questions/statements that the respondents were given pertaining to the original set of eight variables.

Table 3 Ordinary Least Square (OLS) Regression Model of Implementing Agency Capacity

	Predictor	Standardized Regression Coefficient	T-value
POLICY	Government Policy	.264 **	1.830
LEAD	Effective Leadership	.599 **	6.030
TSTAFF	Technical Staff Ability	-.771 *	-1.905
INC	Implementing Agency Incentives	-.563 **	-2.206
PCW	Public Concern about Hazardous Waste Management	.280**	2.181
PFB	Provision of Fringe Benefits	.261	1.084
COMMIT	Government and Agency Leaders' Policy Commitment	-5.5E-02	-.247
RES	Policy Resources	.126	.832
	Constant	35.247 ***	13.200
	$r = .667$		
	$R^2 = .445$		
	Adjusted $R^2 = .391$		

Note: * $p < .10$; ** $p < .05$; *** $p < .001$

As five out of the eight variables were found to significantly influence implementing agency capacity, Hypothesis II was also proven to be accepted.

Factors Affecting Willingness to Comply

The following three variables were proposed as the major determinants of the industrial sector's willingness to comply: 1) its environmental awareness, 2) its environmental conservation expenses, and 3) the environmental conservation incentives available to it. The structural equation of their relationship can be expressed as follows:

$$\text{WCOMPLY} = b_0 + b_1\text{AWARE} + b_2\text{EXPENSE} + b_3\text{INCENTIV} + e \quad \dots\dots\dots(4)$$

Table 4 details the results of multiple regression analysis on the model of the industrial sector's willingness to comply. The independent variables extracted from survey data factor analysis were tested using the multiple regression models which revealed that the three variables above were in fact the three major determinants of the industrial sector's willingness to comply, thus Hypothesis III was proven to be accepted.

Table 4 Ordinary Least Square (OLS) Regression Model of the Industrial Sector's Willingness to Comply

	Predictor	Standardized Regression Coefficient	T-value
AWARE	Environmental Awareness	.794 **	2.858
EXPENSE	Environmental Conservation Expenses of the Industrial Sector	1.0944*	2.294
INCENTIV	Environmental Conservation Incentives for the Industrial Sector	.423 ***	4.202
	Constant	25.513 ***	7.458
	$r = .571$		
	$R^2 = .326$		
	Adjusted $R^2 = .303$		

Note: * $p < .05$; ** $p < .01$; *** $p < .001$

4.4 Models of Factors Affecting Policy Implementation

A Model of Policy Enforcement

The model of policy implementation was then constructed from the results of analysis above. A model of policy implementation is integrated from two models, a model of policy enforcement and a model of policy compliance.

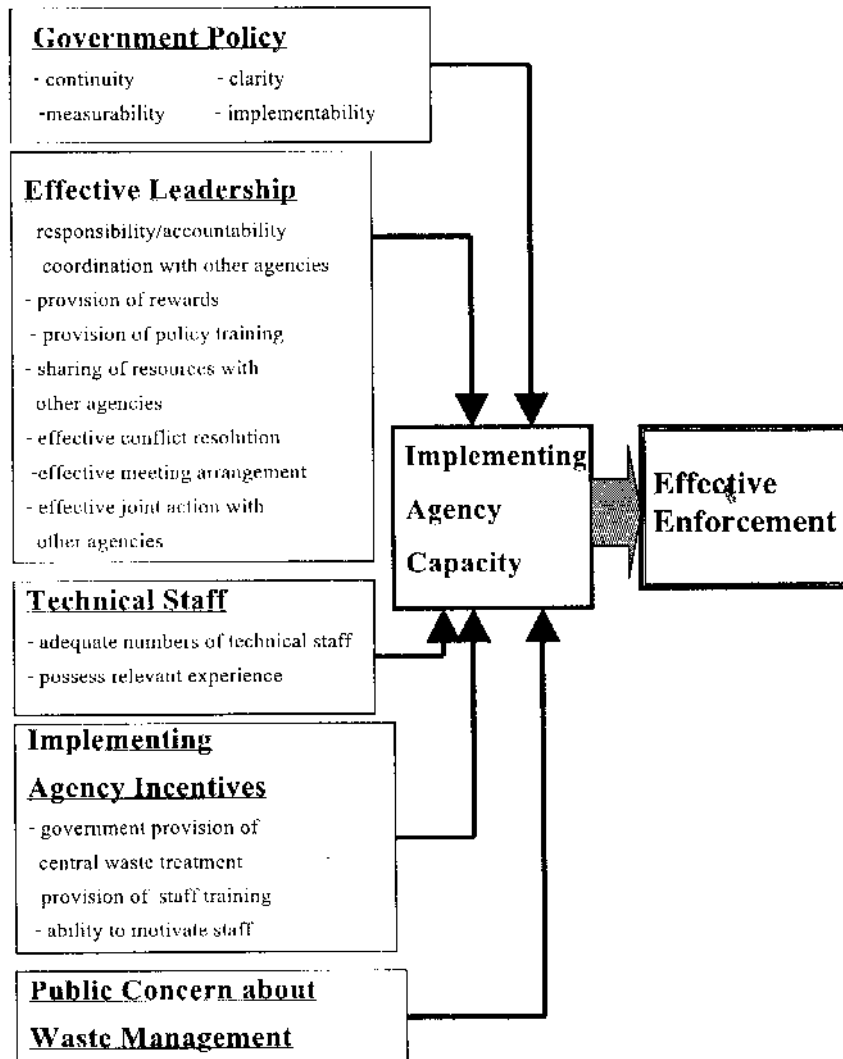


Figure 3 A Model of the Factors Affecting Implementing Agency Capacity and policy Enforcement

As Table 1 and Figure 1 indicate, policy enforcement is strongly determined by implementing agency capacity. This relationship is shown in part of the revised model of policy enforcement shown in Figure 3. In addition, multiple regression analysis (see Table 3) revealed that the five sets of independent variables had a significant relationship to implementing agency capacity. Figure 3 also includes the revised model of how various factors affect implementing agency capacity and how it in turn influences policy enforcement

A Model of Policy Compliance

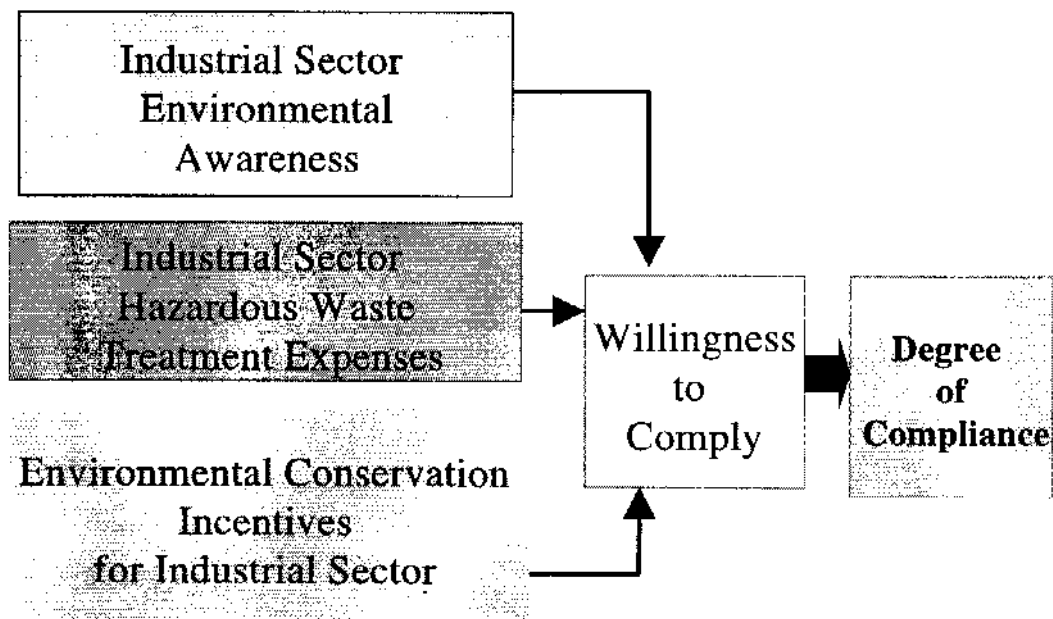


Figure 4 A Model of Policy Compliance

With respect to the private sector, Figure 4 illustrates the model of policy compliance which was developed following the hypothesis testing as detailed in Tables 2 and 3.

4.5 A Model of Policy Implementation Effectiveness

The model as shown below in Figure 5 was obtained by integrating the revised models of policy enforcement and policy compliance (see Figures 3 and 4). The logic for the integration of these two models followed from the observation that effective policy implementation requires both effective policy enforcement and effective policy compliance.

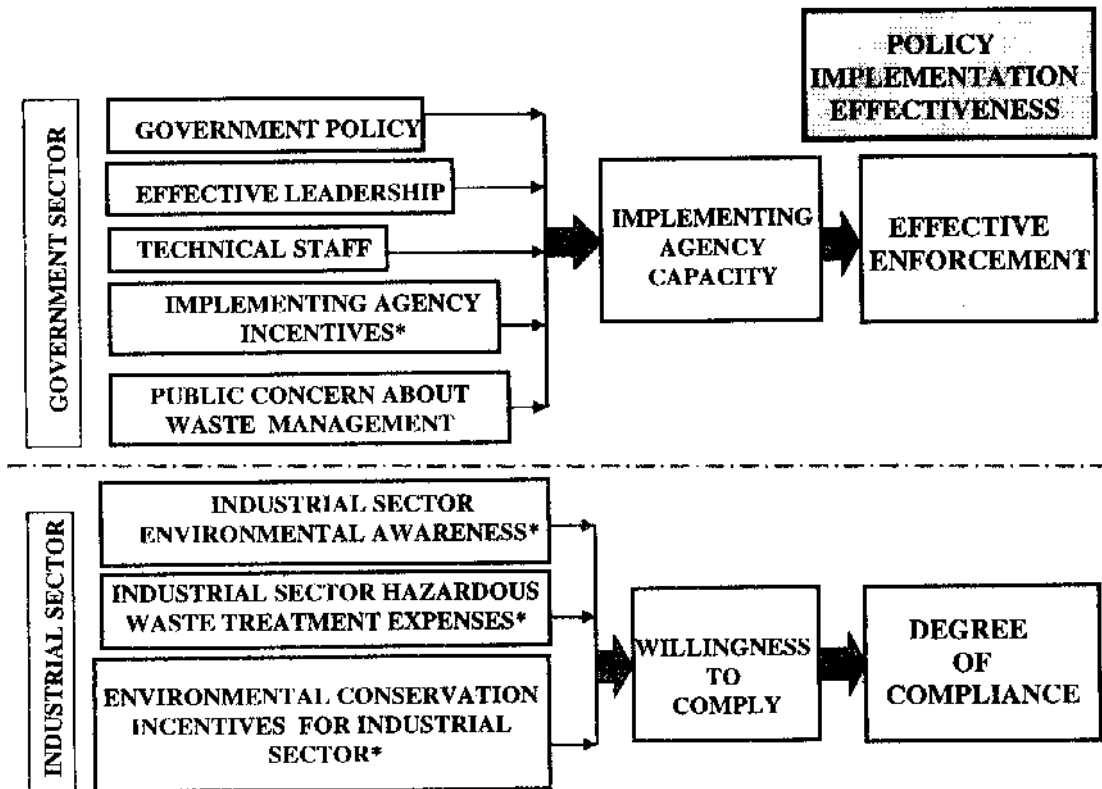


Figure 5 A Model of Industrial Hazardous Waste Policy Implementation in Thailand

The model of industrial hazardous waste policy implementation in Thailand in Figure 5 indicates that the following five government sector independent variables were found to have a statistically significant affect on implementing agency capacity: 1) government policy, 2) effective leadership, 3) technical ability, 4) incentives provided by implementing agencies, and 5) public concern about waste management as a policy issue (see Table 3 and Figure 3 for details).

In the private sector, the willingness of the industrial sector to comply with public policy was found to be determined mainly by three variables: 1) its environmental awareness, 2) its hazardous waste treatment expenses, and 3) the environmental conservation incentives provided to it (see Table 4 and Figure 4 for details).

5. Conclusions

This study indicated that effective policy implementation depended on effective policy enforcement and effective policy compliance. Policy enforcement relied greatly on implementing agency capacity. Similarly, in-depth interviews and participant observations suggested that effective policy enforcement did in fact depend significantly on implementing agency capacity and that implementing agencies do not have sufficient capacity to effectively enforce policy. However, although the level of enforcement by government officials was found to increase in line with implementing agency capacity increased, there was also found to be a maximum enforcement level or ceiling which was determined by existing laws and regulations. In addition, implementing agency capacity itself was basically determined by five major factors: 1) government policy, 2) leadership, 3) technical ability, 4) incentives and 5) public concern. Similarly, the degree of industrial sector compliance depended on its willingness to comply. However, although policy compliance increased as the industrial sector's willingness to comply increased, it cannot exceed the maximum compliance level or as determined by existing laws and regulations. Moreover, the industrial sector's willingness to comply was basically affected by three major factors: 1) its environmental

awareness, 2) its environmental conservation expenses, and 3) its environmental conservation incentives.

With respect to the industrial sector, the industry owners and managers generally expressed their support for environmental conservation efforts, clearly indicating that they wanted to have a sound environment and were willing to comply with policy. In fact, their willingness to comply was found to basically determine their degree of compliance with industrial hazardous waste policy.

After comparing the findings from surveys, in-depth interviews and participant observations, Hypothesis I regarding the factors affecting the effectiveness of policy enforcement and degree of compliance was found to be statistically acceptable, with a non-linear correlation between: 1) implementing agency capacity and policy enforcement and 2) willingness to comply and degree of compliance. As noted earlier, in-depth interviews and participant observations suggested that implementing agency capacity was a major factor determinant of policy enforcement effectiveness. In addition, willingness to comply was found to have some influence on degree of compliance. Moreover, Hypotheses II and III regarding the factors affecting implementing agency capacity and the industrial sector's willingness to comply with policy were also found to be statistically acceptable.

The two major public policy implementation problems found during this investigation concerned enforcement and compliance. Enforcement problems evidently arose due to various factors such as public policies themselves, the behavior of government agencies responsible for implementing these policies, the behavior of public officials implementing these policies, the availability of incentives to agencies, and the agencies' environmental awareness. As for public policy compliance, the major problems evidently originated from industry personnel's lack of environmental awareness, a shortage of proper information on hazardous waste management and policy, inadequate provision of incentives, and the generally high expense of proper hazardous waste management.

Indeed, public policy problems in this area are evidently all strongly related to the fact that no specific policy on industrial hazardous waste management has ever been developed in Thailand. As a result, there exists only an 'ad hoc' system in which various non-specific policies are supposed to be applied by officials of the various agencies involved which themselves were not (and are not) set up for this purpose. In fact, these officials rarely have adequate technical knowledge about hazardous substances or policies related to hazardous waste management, and in any case their number is far too small to achieve much in this area anyway. In addition, the incentives available to them are very limited.

Another serious public policy problem which this study confirmed was that accountability and responsibility for policy enforcement was also inadequate, with government sector leaders for example, rarely understanding the importance of proper hazardous waste management. Similarly, there was relatively little public input at any stage of the policy process, which was particularly regrettable because good public input was recognized as essential to proper policy development and compliance.

The study also found several serious problems in the private sector management of hazardous waste. First, the industrial sector (like most agency officials) seldom had adequate knowledge of industrial hazardous waste policies or environmental awareness; therefore environmental matters likewise rarely formed an important or integral part of company policy. Second, because so few operators had sufficient knowledge about hazardous substances or proper treatment, the hazardous wastes that they generated were usually not properly managed. Third, because employees were not fully aware of the danger in mishandling or mismanaging hazardous wastes, many were routinely exposed to serious health hazards. Fourth, inappropriate treatment of hazardous wastes occurred often, both deliberately and unintentionally, due to either under-investment in proper (but usually expensive) hazardous waste management or through ignorance. Fortunately, while inappropriate treatment due to ignorance remains probably the

most serious single obstacle to proper policy compliance, proper training is one of the most cost-effective ways of improving it.

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