Guidelines for Reducing Environmental Impact in the Industrial Sector of the Eastern Region of Thailand

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Abstract: - This research aims to 1) study the components of the guidelines for reducing environmental impact in the industrial sector of the Eastern Region of Thailand and 2) develop a structural equation model for the guidelines for reducing environmental impact in the Eastern Region industrial sector of Thailand. The research sample for this study comprises 500 entrepreneurs or managers in the industrial sector in the Eastern Region of Thailand. The quantitative research uses a questionnaire as a research instrument. Statistical analysis used for data analysis includes structural equation analysis. The results of the research model developed show that the assumed model is in line with the empirical data with p-value = 0.091, CMIN/DF = 1.272, GFI = 0.980, and RMSEA = 0.023, which meet the research assessment criteria. The analysis results based on the research hypotheses indicate that 1) Legal components have a direct influence on the consultant components, 2) Legal components have a direct influence on the community components, 3) Consultant components have a direct influence on the resource components, and 4) Resource components have a direct influence on the community components. The result found that the component related to environmental consultants directly influences the resource component with the highest Standardized Regression Weight of 0.88. This result indicates that consulting companies must carry out environmental impact reporting processes according to the legal requirements to produce transparent evaluations, resulting in increased community acceptance of the information presented in the reports.

Key-Words: - Environmental impact, Industrial sector, Legal, Consulting, Community, Resources.

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1 Introduction

Outdoor air pollution is a major environmental health problem affecting everyone in low-, middle-, and high-income countries. Ambient (outdoor) air pollution, prevalent in urban and rural areas, was estimated to cause 4.2 million premature deaths annually in 2019. These fatalities result from exposure to delicate particulate matter, leading to cardiovascular and respiratory disease, as well as cancers. Based on data from the World Health Organization (WHO) in 2019, heart attacks and strokes accounted for approximately 37% of early deaths related to air pollution outside, while chronic lung diseases and sudden lung infections were associated with about 18% and 23% respectively. Additionally, 11% of such deaths were connected to cancers in the breathing passages. Individuals residing in low- and middle-income countries bear a disproportionate share of the outdoor air pollution burden, with 89% (of the 4.2 million premature deaths) occurring in these areas. The most substantial burden exists within the WHO regions of South-East Asia and the Western Pacific. The significant function of air contamination in cardiovascular sickness and deaths is highlighted in the most recent burden estimates, [1]. Regulating industrial operations is necessary in Thailand to prevent the release of potentially hazardous materials that could harm the environment. The government has noticeably taken steps to improve and safeguard the environment by enacting the "Enhancement and Conservation of National Environmental Quality Act of 1992," a fundamental environmental law in Thailand. This law superseded prior rules protecting

national environmental quality dating back to 1975. The program addresses various contamination issues, including water pollution, air pollution, waste handling, noise, and vibrations. Depending on their type, an environmental impact review is required for specific infrastructure, condominiums, and other initiatives, [2]. The main goal of the EIA process in Thailand is to ensure decision-makers think about environmental effects when approving initiatives. This proactive step is taken to achieve sustainability targets and prevent ecological problems arising from significant industrial enterprises. The environmental impact assessment process necessitates identifying the potential effects an existing or proposed undertaking may have on the natural surroundings. It also involves creating strategies to lessen negative impacts on the environment, [3].

Even though this process of examining potential environmental consequences has been used in Thailand for approximately three and a half decades, debate continues. Some project leaders consider the assessment unnecessary, while others try to avoid it. Government officials overseeing the review face considerable difficulties, [4]. Furthermore, environmental impact assessment often lacks robust backing in many developing countries, including Thailand, usually due to political and monetary constraints. Agencies focusing on protecting the environment frequently find themselves with less authority compared to organizations prioritizing economic growth. Two primary factors that compromise the quality of EIA reports are the shortage of qualified environmental experts and constraints in terms of time and funding, [5]. Thailand is no exception to these challenges. However, there remains a need for continuous improvement in the EIA process, improvements that consider the specific project, the geographic context, and associated factors to encourage the adoption of effective public participation methodologies. Social impact assessment (SIA) processes not only assess the project's impact but can also be used to understand and ultimately minimize the negative attitude of neighboring communities, [6].

Industrial establishments are considered vital drivers of a country's long-term economic growth. Consequently, the government aims to develop and strengthen these industries, making them competitive and capable of supporting the nation's future prosperity. However, when assessing the environmental impact of projects or industrial activities that do not meet the approval criteria set by the Department of Natural Resources and Environmental Policy and Planning, it not only poses risks to the businesses themselves, including issues related to trustworthiness among stakeholders, but it can also harm the overall economic growth rate, particularly in the industrial sector, which may not meet the predetermined objectives. For this reason, the researcher is keen to investigate guidelines for reducing environmental impacts in the industrial sector of the Eastern Region of Thailand. The aim is to provide business operators with insights from this research to inform project development and improve the environmental impact assessment reports.

1.1 Research Objectives

1) To investigate the components of guidelines for reducing environmental impacts in the industrial sector of the Eastern Region of Thailand.
2) To develop a structural equation model for the guidelines for reducing environmental impacts in the industrial sector of the Eastern Region of Thailand.

2 Literature Review

2.1 Environmental Impact Assessment

An evaluation of effects on living things and human welfare, as well as general environmental circumstances, is called an Environmental Impact Assessment. It is a methodical process. The goal is to assess how activities might change things over time. This includes plans set by law, projects, policies, standard practices, explanations, and information sharing. It is important to consider how current decisions may affect the future and to learn from past experiences, [7]. As some have noted, [8], evaluating potential environmental effects helps examine possible benefits and challenges of a proposed plan or project. The review aims to understand the impacts on people, property, and nature. It seeks ways to lessen negative impacts while increasing positive outcomes. The goal is to make decisions consistent with environmental sustainability through a thorough assessment process.

An important objective of the environmental evaluation is discovering techniques for limiting detrimental results while strengthening favorable impacts. Chief among our concerns is confirming that evaluations of intended initiatives and tasks align with the sustainability goals intrinsic to the

assessment procedure. The origins of environmental effect appraisal can be traced back to the National Environmental Policy Act of 1969 in the United States. This concept arose from realizing numerous publicly supported plans overlooked potential environmental repercussions during planning and implementation, inevitably leading to serious environmental issues. It was initiated because several government-funded projects failed to consider their environmental impacts during development and execution, resulting in substantial environmental issues. Historically, analysis of cost, benefit, and environmental protection was the primary focus, but it was inadequate for safeguarding the environment within the country. Consequently, public awareness regarding the environment grew, leading to a movement that eventually enabled the enforcement of EIA as a mandatory law starting in January 1970. EIA became a global foundation for similar legislation worldwide in the 1970s and 1980s for developed countries. Countries in Asia that were developing, such as Indonesia, Taiwan, the Philippines, Singapore, and Hong Kong, embraced the concept of EIA within their policies by 1990. Subsequently, African and Latin American countries adopted this approach, [9].

In Thailand, the formal beginning of environmental legislation occurred with the passing of the National Environmental Quality Advancement and Preservation Act 1975. This Act established the National Environmental Board, tasked with specific responsibilities, including developing policies and recommendations to boost and safeguard environmental quality. Another crucial role involved assessing initiatives that could negatively impact the natural world. Subsequently, the Act underwent revisions in 1978, resulting in its second version. Specifically, regarding the authority and duties of the National Environmental Commission, these changes aimed to address vague areas and weaknesses in the original Act. However, despite these attempts, some key details remained undefined, leading to challenges in implementation. Then, the government was required to tackle these issues; further modifications were made in 1975 and 1981 to provide more explicit and inclusive powers and accountabilities to the National Environmental Board.

Furthermore, in 1981, a new policy was introduced to evaluate the environmental effects of specific project categories and scales. Under the authority of the Ministry of Science, Advancement, and the Surroundings, this policy took impact on September 27, 1981. It centered on analyses of environmental assets and the significance that diverse projects or deeds could have. In 2002, the government changed how it handles things. The Ministry of Science, Technology, and Environment is now responsible for the National Environmental Quality Promotion and Conservation Act 1992 (B.E.2535). In April 2018, a revised version of the National Environmental Quality Promotion and Conservation Act (Version 2) was enacted, with multiple subordinate laws issued to establish clear frameworks and impose penalties for non-compliance. These legal measures were intended to compel businesses to consider environmental impacts more seriously, ensure the creation of accepted standards, and foster confidence from all stakeholders in environmental quality and natural resource conservation. The country's sustainable development was balanced with maintaining environmental quality and natural resources, [10].

The following are 4 benefits of EIA that need attention and can be seen from various aspects, [11]:

1) The benefits of EIA for the government are more related to policy formation. The government has higher authority than any party. Therefore, the use of an EIA is to help prevent more severe environmental damage and pollution. In addition, the EIA project benefits the government; this project can be used as a form of government responsibility in preserving and protecting the environment. The ultimate goal remains the same: avoiding conflicts or disasters that will endanger the community.

2) The owner of capital here can be exemplified as a bank that holds power over the fortune of entrepreneurs. The benefit of having an EIA for capital owners is that it is easy to provide loan capital for a development or project. That is if a party borrows money from a bank to build a project and the EIA of the project is good and of good quality. So, banks must provide loans for this development.

3) The next benefit of EIA is for project owners or companies, where EIA is essential for a company. The EIA will benefit the project owner because it will guarantee that project development will continue without violating the applicable laws and regulations. An example is when a housing complex is constructed; the developer must have a good EIA. That way, the government and capital owners will give permission easily. In addition, the

community also did not feel disturbed by this development.

4) The last benefit is for the community or residents. EIA provides valuable benefits for the district to know about specific development plans. In addition, the community can also become supervisors of projects that are being implemented. EIA empowers the community to be more vigilant and conscious of the various development projects. For instance, in creating a national park, the community's involvement ensures that the project respects environmental considerations, such as preserving animal habitats and minimizing disturbances.

2.2 Corporate Social Responsibility Theories (CSR Theories)

Corporate Social Responsibility (CSR) is the responsibility of an organization towards society and the environment, which involves conducting business ethically and responsibly, considering both internal and external aspects of the organization. The goal is sustainable development, [12]. This theory posits that business organizations adhering to solid ethical values acknowledge the importance of societal responsibility. These businesses recognize that an organization's social responsibility can lead to societal acceptance and should encompass four dimensions: 1) Economic Responsibility, 2) Legal Responsibility, 3) Ethical Responsibility, and 4) Philanthropic Responsibility. Therefore, business organizations must consider social responsibility across all four dimensions to gain greater acceptance from various segments of society. The social and environmental responsibility of organizations is categorized into seven activities, [13], including 1) Promoting awareness of social issues, 2) Market activities related to societal concerns, 3) Market activities aimed at addressing social issues, 4) Philanthropic donations, 5) Community volunteering and support 6) Conducting business with social responsibility and 7) Developing and delivering products and services.

From this perspective, it becomes evident that business organizations should not solely pursue profit but also emphasize the importance of social and environmental responsibility. Moreover, this perspective underscores that business organizations also thrive when society thrives.

2.3 Setting the Research Hypotheses

Based on the research objectives and relevant literature, the researcher has formulated four research hypotheses:

Hypothesis 1 (H1): Legal components directly influence the consultant components.

Hypothesis 2 (H2): Legal components directly influence the community components.

Hypothesis 3 (H3): Consultant components directly influence the resource components.

Hypothesis 4 (H4): Resource components directly influence the community components.

2.4 Research Conceptual Framework

A research conceptual framework has been developed through a review of the literature, related research, and hypothesis formulation, as depicted in Figure 1.

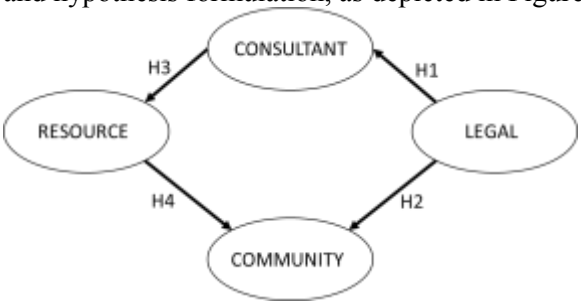

Fig. 1: Research Conceptual Framework

3 Research Methodology

3.1 Population and Sample Groups

The population used in this research consists of entrepreneurs or industrial plant managers authorized to operate in Thailand's Eastern Region, totaling 11,466 entities, [14]. This research employs hypothesis testing and analyzes results using Structural Equation Modeling (SEM). The number of sample groups used for analysis is calculated based on the proportion between the sample units and the number of parameters or variables, as per the formula, [15]. It is recommended that the appropriate number of sample groups for multivariate analysis should be at least 5-10 times the number of indicators. Since this research involves a questionnaire with 40 questions, the minimum number of sample groups should be approximately 400. Therefore, data was collected from 500 sample groups using purposive sampling.

3.2 Research Tools

A purposive sampling technique was used to select the sample group for the qualitative research conducted through in-depth interviews with nine experts. The research tools used for this phase of the study were structured interviews, with the researcher outlining the interview guidelines into four components: legal aspects, company components involved in preparing reports, resource components, and community components. The structured interview questions were of an open-ended nature. Subsequently, the researcher designed a draft questionnaire, which was used for the quantitative research. This questionnaire was in the form of a Rating Scale, with five levels of evaluation based on Likert's method, [16]. The researchers ensured the quality of the questionnaire, which was examined by five experts with knowledge and experience in the area to assess the quality of the tool using the Index of Item-Objective Congruence (IOC). The index value for item congruence with the research objectives ranged from 0.60 to 1.00, with the appropriate value being 0.50 or higher, [17]. The researcher then conducted a Try-Out with 30 participants who shared similarities with the intended research population. This Try-Out aimed to determine the Discrimination values for checklist-type questions. The Standard Deviation (S.D.) and Correlation values were analyzed in the rating scale questions. The reliability analysis of the questionnaire revealed a Discrimination value ranging from 0.45 to 1.39, and the overall reliability of the questionnaire was calculated to be 0.99, considered excellent, [18]. Following this validation process, the research tools were used for data collection by requesting responses through questionnaires from the sample group.

3.3 Data Analysis

Data analysis involved both descriptive statistics and inferential statistics using the SPSS software. The AMOS software was utilized for multivariate statistical analysis and structural equation modeling. Four criteria were employed to assess the data-model fit: 1) The p-value (probability value) should be more significant than 0.05 2) The CMIN/DF (Chi-square divided by degrees of freedom) should be less than 2.00 3) The GFI (Goodness of Fit Index) should be greater than 0.90 and 4) The RMSEA (Root Mean Square Error of Approximation) should be less than 0.08, [19]. Outlining four criteria for structural equation modeling, researchers must adapt their research models to meet all of these criteria. Therefore, the model can be considered complete acceptance and reliable according to the principles of the research process.

4 Results

The analysis of the research objectives, which aimed to study the components of the environmental impact reduction guidelines in the Eastern Economic Corridor (EEC) of Thailand's industrial sector, consisted of 4 components: Component 1, Legal Aspects; Component 2, Companies Providing Advisory Services (Consultant); Component 3, Resource; and Component 4, Society (Community). These four components were derived from a literature review and related research. Based on the analysis of the structural equation model developed by the researcher, it was found that the model did not meet the criteria for data fit, with a p-value of 0.000, CMIN/DF of 3.482, GFI of 0.781, and RMSEA of 0.071. The statistical significance was at the 0.001 level, which did not meet the criteria. Therefore, adjustments were made to the model by considering pairs of variables with the highest Modification Indices (M.I.). The model was adjusted using three methods, [20]: 1) Adjusting the components by removing certain variables, 2) Adjusting the components by combining variables, and 3) Adjusting the components by adding arrows; the adjusted model showed a good fit with the data, with a p-value of 0.091, CMIN/DF of 1.272, GFI of 0.980, and RMSEA of 0.023. The statistical significance was at the 0.001 level and met the criteria established in compatibility with the literature and empirical data, as shown in Figure 2.

Thirteen observational variables are explained after the model is consistent with the empirical data, as shown in Table 1.

Results of hypothesis testing to analyze the causal influence of latent variables in the structural equation model of environmental impact reduction guidelines in the industrial sector of the Eastern Region of Thailand are four hypotheses as follows:

Table 1. Observational variables

Abbreviation	Description
Legal	
LGL003	Impact assessments must specify air pollution management methods.
LGL005	Impact assessments must specify methods for managing hazardous chemicals.
LGL006	Impact assessments must specify odor pollution management methods.
LGL008	There are green area projects to reduce environmental impacts.
LGL009	Impact assessment results can be continuously monitored throughout the project.
Consultant	
CNT028	Consulting companies must emphasize accurate and up-to-date data that complies with standards.
CNT030	Consulting companies must provide information to the committee every time.
Resources	
REC055	Establish channels for disseminating information in the report more extensively.
REC056	Utilize information technology systems to store project documentation.
REC060	Include accurate data on human resource usage in the report, such as transportation and water consumption.
Community	
CTY079	Engage in activities beyond legal requirements to demonstrate social responsibility to the community.
CTY081	Implement appropriate measures for preventing, addressing, and compensating for the impact on affected communities.
CTY085	Consistently support various community activities.

Hypothesis 1 (H1): The legal component directly influences the component related to companies providing consulting services for report preparation. This testing result is statistically significant at the 0.001 level with a Standardized Regression Weight of 0.75.

Hypothesis 2 (H2): The legal component has a significant direct influence on the community-related component. This testing result is statistically significant at the 0.001 level with a Standardized Regression Weight of 0.25.

Hypothesis 3 (H3): The component related to companies providing consulting services for report preparation significantly influences the resource-related component. This testing result is statistically significant at the 0.001 level with a Standardized Regression Weight of 0.88.

Hypothesis 4 (H4): The resource-related component has a significant direct influence on the community-related component. This testing result is statistically significant at the 0.001 level with a Standardized Regression Weight of 0.66.

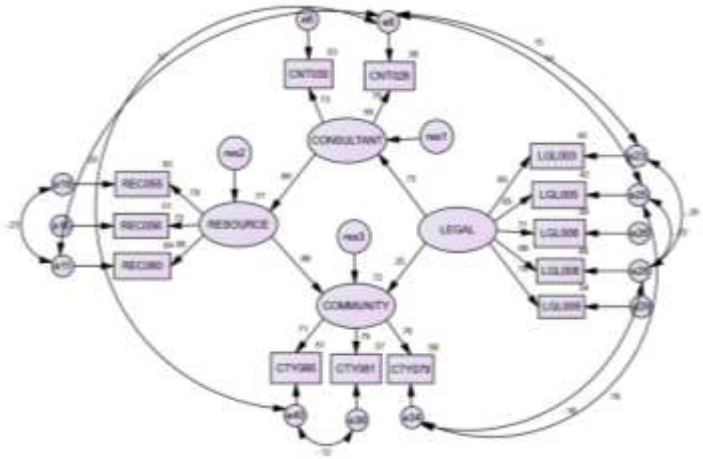

Fig. 2: Structural Equation Model Path

5 Discussion

The results of the model analysis based on the research hypotheses, as depicted in Figure 2, can be discussed as follows:

5.1 Legal Component

The legal component significantly influences the component related to companies providing consulting services for report preparation. This finding aligns with, [21], which studied the legal consulting role in terms of responsibility and societal impact. It revealed that when legal consulting companies for businesses in Indonesia operate transparently, comply with laws and regulations, possess practical communication skills, and make informed decisions; they can foster positive relationships between businesses and communities. These companies can also contribute to achieving a balance between economic, environmental, and social problem-

solving. Additionally, the study by, [22] found that amending specific regulations and procedures to make them more accessible and manageable resulted in legal consulting companies working more effectively. 2) The legal component also directly influences the community component. This result is in line with findings from, [23], which concluded that empirical research in China showed that perceived behavioral control, subjective norms, inward attitude, and outward attitude all positively affect environmental intentions, indirectly affecting the environmental behavior of citizens and environmental activists. Moreover, legal awareness positively moderates the relationship between environmental preferences and behaviors. As public legal awareness increases, the direct influence of these environmental intentions on environmental behaviors also continues to grow. These findings provide valuable insights for governments and legislators to enhance public engagement in environmental protection. Additionally, the study by, [24] indicated that the effectiveness of environmental impact assessments, as perceived by supporters, increases public acceptance.

5.2 Consultant Component

The consultant component directly influences the resource component, in alignment with findings from, [25]. This study highlights the primary roles of environmental consultants in two regulatory programs, emphasizing their roles as trusted facilitators in interactions between regulatory bodies and businesses. They also serve as guardians of public values, which have been relatively underrepresented in existing literature on business and environmental issues. Furthermore, the work of, [26] stresses that environmental consultants provide guidance and support to industries involved in environmentally-related projects and sustainable development. Competency evaluation allows organizations to define the potential of existing competencies and identify areas for improvement.

5.3 Resource Component

The research results by, [27] are helpful for business entrepreneurs who require effective long-term relationship management strategies to enhance value co-creation among business partners. Resource sharing was the most potent tool for co-creating values among business partners. The resource component directly influences the community component, as corroborated by, [28]. The findings are community monitoring can track environmental phenomena, resource use, and natural resource management processes of concern to community members. It can also contribute to planning and decision-making and empower community members in resource management. Enhancing community monitoring effectiveness requires improved data collection, more efficient data management and sharing, and more robust efforts to address community information needs. It should also facilitate conflict resolution and reinforce self-determination. As highlighted by, [29], managing natural resources using environmental-forest education to generate information about natural environmental phenomena has become a key factor. Therefore, forms of environmental forest education and community participation hold growing importance nowadays.

6 Conclusion

Based on the testing of hypothesis 3 (H3), it was found that the component related to environmental consultants directly influences the resource component with the highest Standardized Regression Weight of 0.88. This result indicates that consulting companies must carry out environmental impact reporting processes according to the legal requirements to produce transparent evaluations, resulting in increased community acceptance of the information presented in the reports. Government agencies, on the other hand, must enforce legal regulations rigorously. The environmental impact assessment system aims to promote transparency in safeguarding the industrial sector's social, environmental, and public health aspects. Therefore, every organization, whether governmental or consulting companies, should fulfill their duties transparently by legal principles, fostering sustainable business growth.

7 Suggestions

1) The government should intensify legal amendments related to environmental impact assessments and enforce laws more rigorously to penalize project owners who collaborate with consulting companies in providing false environmental impact assessment reports.

2) Industrial establishments should initiate their operations by adhering to relevant regulations and engaging sincerely in activities with the public or communities. This strategy will help foster better relationships, thereby enhancing the image of industrial establishments.

3) The consultant should work transparently and conduct comprehensive environmental impact assessments following legal procedures.

4) The local community affected by environmental impacts should become more engaged and express their views directly in the environmental impact assessment process. This acting will lead to high-quality feedback and informed opinions.

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Contribution of Individual Authors to the Creation of a Scientific Article (Ghostwriting Policy)

- Yutthajakr Uttajarern carried out the conceptualization, methodology, project admistration, resources, visualization, writing, and editing.
- Rungroj Subanjui has implemented the methodology, investigation, and review.

All authors discussed the results and contributed to the manuscript.

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Conflict of Interest

The authors have no conflict of interest to declare.

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