

ENVIRONMENTAL IMPACT ASSESSMENT (EIA) COMPLIANCE: A CASE STUDY OF HOUSING AND COMMERCIAL DEVELOPMENT ACTIVITY IN SABAH

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<http://doi.org/10.46754/jssm.2025.11.008>

Submitted: 5 November 2024

Revised: 9 April 2025

Accepted: 27 April 2025

Published: 15 November 2025

Abstract: This study presents a bibliometric analysis of machine learning applications in fisheries management from 2010 to 2023. Using the Scopus database, 183 publications were identified with the keywords “machine learning” and “fisheries management”. Bibliometric analysis was conducted using Microsoft Excel and VOSviewer (version 1.6.18) to examine publication trends, including country, author, and keyword distributions. The results show a steady increase in machine learning applications during the studied period, with contributions from more than 50 countries, highlighting its global significance. The United States leads in institutional contributions, with Pittman and Brown cited 202 times, standing out as the most influential work. Frequently occurring terms such as “machine learning” (64 occurrences) and “fisheries management” (20 occurrences) illustrate the central themes and research focus areas. This study offers valuable insights into research trends, key contributors, and thematic developments, enabling researchers to identify deep learning topics and gaps in machine learning applications for fisheries management. By mapping the evolution of this field, it enables academics and policymakers to align future research with practical challenges, thereby enhancing data-driven decision-making in fisheries management. The findings serve as a foundational reference for advancing sustainable fisheries practices through artificial intelligence and support interdisciplinary collaboration for addressing critical global fisheries challenges.

Keywords: Housing and commercial development, prescribed activities, environmental impact assessment, non-compliance aspects.

Introduction

EIA in Malaysia and the State of Sabah

In Malaysia, the Environmental Impact Assessment (EIA) process plays a crucial role in sustainable development by systematically evaluating and mitigating potential environmental impacts associated with proposed development projects. This approach aligns with the country’s National Environmental Policy (NEP) and is governed by relevant laws and regulations. The NEP outlines the government’s commitment to sustainable development and emphasises the integration of environmental considerations into development planning, making the EIA process a cornerstone of responsible project implementation (Ministry of Science, Technology and The Environment (MOSTE), 2002).

The Environmental Quality Act 1974 (EQA 1974) is the primary federal legislation in Malaysia that provides for EIA, with the aim of preventing, reducing, and controlling pollution, as well as enhancing environmental quality (DOE, 1974). The Act empowers the DOE to regulate and monitor activities that may have environmental impacts (DOE, 2015). The Environmental Quality (Prescribed Activities) (Environmental Impact Assessment) Order 2015 is a subsidiary legislation under the Environmental Quality Act. This order provides detailed procedures and requirements for the EIA process.

Under Article 95D and Ninth Schedule of the Federal Constitution, Sabah and Sarawak

have additional autonomy over their natural resources, including forests, land use, and environmental regulations (Malaysia Federal Constitution, 1957). Therefore, only certain prescribed activities in the First Schedule and Second Schedule apply to Sabah and Sarawak (DOE, 2015) and the rest will be under the state's jurisdiction. For the state of Sabah, the jurisdiction related to the environment and EIA fall under the Environmental Protection Enactment Act 2002 and the Prescribed Activities Order 2005 and the Environmental Protection Department (EPD) is tasked with protecting human health and the environment for the state of Sabah (EPD, 2023).

Environmental management in Sabah is guided by the Sabah State Policy on the Environment (Ministry of Tourism, Culture and Environment (MTCE), 2017). The state government recognises the environment's role in sustainable development, requiring policies that incorporate environmental factors and standards into all development activities to ensure environmental and social sustainability (MTCE, 2017), which is in line with the National Policy on the environment as well as the Sustainable Development Goals (SDGs).

Based on the EIA requirement by EPD, any person who intends to carry out any prescribed activities shall submit an EIA report or a Proposal for Mitigation Measures (PMM) to the Director of EPD and obtain approval for the report before any commencement of the activity (EPD, 2002). EPD requires all project proponents with EIA/PMM approvals to comply with any terms and conditions by signing an Agreement of Environmental Conditions (AEC) or Mitigation Declaration (MD) before the commencement of the activity (EPD, 2005). The AEC/MD consists of a list of environmental conditions for the project proponents to comply with, including the implementation of proposed mitigation measures, the appointment of an Environmental Officer (EO), and a requirement to submit an Environmental Compliance Report (ECR) by the project proponent through an appointed Environmental Consultant to EPD.

Primary Guidance for Environmental Assessment and Environmental Compliance with the Agreement of Environmental Conditions in Sabah

To ensure compliance with EIA requirements, the EPD took a step further by adopting a Handbook for Environmental Impact Assessment in Sabah, which is now in its third edition. The handbook aims to guide project proponents, environmental consultants, and other stakeholders in the environmental assessment process, in the preparation of the relevant reports to ensure that the environmental assessment system remains a relevant and effective tool for environmental sustainability in Sabah (EPD, 2023).

Housing and Commercial Development Activity in Sabah

In Sabah, housing and commercial development are major development activities (EPD, 2021). This includes the development of housing, commercial or industrial estates, conversion of wetland forests into housing, commercial or industrial estates and development of housing, commercial or industrial estates on hills with slopes having a gradient of 20 degrees or more (EPD, 2021). Many elements are involved in implementing these activities such as the opening and clearing of an area, earthworks, hill cutting, reclamation, and stone quarrying. These activities can cause significant environmental impacts if carried out without any control measures (Environment Protection Department (EPD), 2021).

In 2021, EPD developed Standard Operating Procedures (SOPs) for Compliance with Environmental Conditions of Housing and Commercial Development in Sabah as a mechanism to guide project proponents in enhancing compliance with environmental conditions as well as promote self-regulation practices by the project proponents (EPD, 2021). This document comes with the Environmental Self-Regulation (ESR) Guideline that aims to involve project proponents in environmental management as well as to promote environmental

stewardship among the stakeholders (EPD, 2021).

Environmental Issues Related to Post-EIA for Housing and Commercial Development Activity

Compliance issues identified by EPD, based on on-site inspections/report assessments, include inconsistent or delayed ECR submissions by project proponents and non-compliance with the AEC/MD implemented on the ground (EPD, unpublished data). These have caused various environmental issues, including water pollution from improper oil handling and uncontrolled sedimentation from the project site, air pollution from open burning and construction site dust, as well as noise and other problems (EPD, unpublished data).

Based on Lyhne *et al.* (2017), EIA contributes to the environmental awareness of the competent authority and the project proponent. Government mechanisms such as legal requirements, participation and involvement of stakeholders, and the quality of the environmental assessment report are perceived to be crucial determinants of EIA effectiveness (Moduying, 2007; Chew & Vun, 2013; Lyhne *et al.*, 2017). Furthermore, effective communication and stakeholder engagement are considered crucial to ensure transparency for prudent decision-making (Moduying, 2007; Zhang *et al.*, 2013; Tang, 2019).

The EPD has taken legal action and initiated regular engagements with identified project proponents involved in implementing and preparing the compliance report. These engagements aim to raise awareness about their roles and responsibilities and to discuss any issues they may have (EPD, unpublished data). This study aimed to identify the key factors affecting environmental compliance. The result of this research is beneficial in addressing the main factors that contribute to non-compliance in the approved EIA project, strengthening measures to boost EIA compliance and effectiveness, and exploring measures to address factors that impede effective compliance.

Methodology

Scope and Research Design

The challenges and limitations faced by EPD served as the point of focus for this research. Using a mixed-method design, key factors contributing to non-compliance with EIA requirements, which potentially affect environmental conditions were identified.

Mixed-method research involving both qualitative and quantitative methods was used to identify the factors affecting non-compliance. The fundamental principle of mixed research encourages researchers to carefully consider incorporating or combining quantitative and qualitative research methods to develop a comprehensive design with several complementary and convergent strengths (when viewed broadly) and nonoverlapping weaknesses (Johnson & Christensen, 2014). The qualitative data were gathered through secondary data collection from EPD records/reports and interview sessions while the quantitative data were collected from an online survey.

Data triangulation was used to explore and capture different perspectives as well as improve the reliability of the research (Chua, 2016). It also served to ensure reliability of the questions and increase validity of the findings through multiple methods of data collection (interview and online survey) as well as different categories of respondents (Lyhne *et al.*, 2017). In this study, triangulation was achieved using EPD records and reports, interview data, and online survey responses.

Through these methods, various research questions concerning issues and problems from multiple perspectives can be answered (Chua, 2016). Three main steps were involved in conducting this research, as summarised in Figure 1.

The collected interview data were transcribed and coded according to the identified theme and analysed using thematic analysis. Social science researchers commonly use this method to analyse recorded interview transcripts that will provide valuable insights

<p>Stage 1 (Literature Review and Baseline Study)</p>	<ul style="list-style-type: none"> ▪ Literature review and development of research design. ▪ Determination of targeted respondents and sample size. ▪ Consent was obtained from EPD’s Director on data accessibility. ▪ Development of interview questions.
<p>Stage 2 (Data Collection)</p>	<ul style="list-style-type: none"> ▪ Data collection was carried out from secondary data sources (relevant reports, department database, and information from the official department website). ▪ Interview and survey questions were submitted to the expert for validation. ▪ Invitation letters were sent to all targeted interviewees. ▪ Pilot testing of the final survey questions. ▪ Interviews were conducted via physical and online platforms. ▪ Distribution of survey questions to targeted groups (Project Proponent, Environmental Officer, and Environmental Consultant) through e-mail and other social media platforms.
<p>Stage 3 (Data Analysis)</p>	<ul style="list-style-type: none"> ▪ Data analysis was done using content analysis. ▪ Online survey data were analysed using Microsoft Excel.

Figure 1: Overall research process

into communication dynamics and human behaviour (Chua, 2020). Figure 2 shows the overall process of qualitative data collection and analysis.

Baseline Study and Development of Interview and Survey Questions

A baseline study using content analysis method for housing and commercial development activity was conducted on all records available in EPD such as public complaint records regarding environmental issues caused by housing and commercial activities, repeated non-compliance environmental aspects recorded in Environmental Compliance Report (ECR) for 2018-2022, record of ECR submission by project proponents, legal actions taken by EPD recorded in the enforcement records, relevant

online and offline database, and EPD official website. The records on housing and commercial development activities were based on completed and ongoing EIA projects in Sabah from 2018 through 2022. All the unpublished data related to the activity and the time were retrieved from EPD records with the written approval from the Director of EPD.

Interview questions were developed based on the baseline study and literature review to understand the issues better. The questions were open-ended, semi-structured and prepared in two languages (Malay and English). Semi-structured, questions were prepared to obtain more information about an issue that required elaboration from the interviewees. Different language levels were used, some questions were rephrased and arranged accordingly to

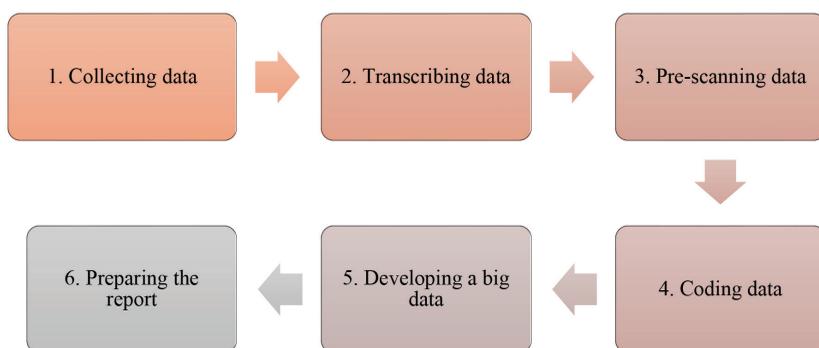


Figure 2: The process of qualitative data collection and analysis

suit each interviewee's expertise and experience (Chua, 2016). Interviewees included Project Proponents (top management at the supervisory level and above), Environmental Officers (EO) appointed by these proponents, Environmental Consultants registered under EPD, and EPD Officers. The selected interviewees represent stakeholders, who have an important role and responsibility in post-EIA monitoring for housing and development activity in Sabah.

The survey questions targeted at the project proponent, environmental officers, and environmental consultants were also constructed based on initial factors identified from the baseline study and literature review. A combination of Likert scale, multiple-choice, and closed and open-ended questions was used in the survey. These questions were checked and validated by experts, pilot testing was carried out on the survey questions on different groups of respondents to test their understanding of the questions (Kelley *et al.*, 2003).

Data Collection and Analysis

Interview

The interview sessions were conducted in stages from May to August 2023 through face-to-face interviews and online platforms. All 20 interviewees, including five EPD Officers, five Project Proponents, four Environmental Officers, and six Environmental Consultants were contacted through email and other communication platforms such as WhatsApp and Telegram. The letter of invitation, which outlines the interview's objective and the required information from the interviewee was sent earlier. Consent was obtained from all interviewees to ensure voluntary participation. Interviews were conducted for this research to gather more feedback on stakeholders' views of the main factors contributing to environmental compliance. Stakeholders were invited to share their experiences and perceptions on this matter freely.

Survey

The online survey questions were distributed in August 2023 to all targeted respondents through email and other communication platforms like WhatsApp and Telegram. For the Environmental Consultants, the online survey questions were distributed to all firms with experience in doing EIA or preparing ECR for development activities in Sabah. As for the Project Proponents and Environmental Officers, the survey was distributed to all companies involved in housing and development activities in Sabah only.

A total of 26 respondents, consisting of 10 Project Proponents, six Environmental Officers, and 10 Environmental Consultants participated in the survey, which represents each category of the targeted respondents for the research. The quantitative data collected from the online survey were analysed using Microsoft Excel and the results were presented in tables and charts. To increase the reliability of the data, some questions were asked of the same respondents in both the interview and the online survey.

Results and Discussion

A total of 15 male and five female interviewees, consisting of EPD Officers, Environmental Consultants, Project Proponents, and Environmental Officers were interviewed separately through physical and online platforms. The online survey was circulated through email and other communication applications such as WhatsApp and Telegram to 26 Environmental Consultant firms, 16 Project Proponents, as well as their appointed Environmental Officers. Out of these, a total of 17 male and nine female respondents participated in the survey. The working experiences of all participants ranged from 1 to 35 years while their ages ranged from 25 to 75 years old, with most under 45 years old.

Factors Affecting the Non-compliance and Inconsistent Submission of ECR

Findings from baseline data analysis

Based on the analysis of the environmental compliance reports, several factors affect the environmental non-compliance. The first factor involves preparing a slope stabilisation and rehabilitation plan, which requires expert approval and approval from other government authorities. If the plan is not submitted within the specified timeframe, it may result in repeated non-compliance. Another factor identified is the need for conditions that require cost, expertise, and time such as constructing retaining walls, a used oil and toxic waste facility, and the sedimentation pond and silt trap, including roofing, oil traps, and drainage. Another observation was on controlling surface runoff and water quality pollution, specifically on the water sample laboratory tests. Due to more prolonged laboratory testing procedures and processing time, the result of the water sample was usually not ready by the submission date. It was only submitted in the next ECR, causing repeated non-compliance.

EPD should reassess the submission frequency for certain conditions that require more time to prepare, ensuring compliance within the required timeframe. Another option that EPD can consider is separating the environmental conditions into different phases of compliance or different timelines such as immediate, during the earthwork phase only, or after the earthwork is completed. This consideration can be applied when enhancing the existing SOP for project proponent guidance to address the issue of the time factor.

For conditions requiring certain expertise and time to prepare, project proponents need to be given ample time before it is reported as non-compliance in the ECR. Further discussion with the other approval authority is beneficial before determining the timeline for compliance. Furthermore, early planning by the environmental consultant to conduct water sampling can ensure that the submission deadline

is met. Another option is to discuss with EPD the reporting frequency adjustment according to the practical timeline. Unclear criteria or internal guidelines, as well as a lack of enforcement by the government were mentioned as contributing factors for the inconsistent submission of ECR by the project proponent. Another reason for the lower submission of reports within the study period was observed during the Movement Control Order (MCO) enforced by the government during the COVID-19 outbreak in Malaysia from March 18th until August 2020.

Findings from interviews

For the interview session, the questions varied according to the categories of interviewees. The EPD officers were asked about their opinion and experience on the main factors affecting environmental non-compliance. Meanwhile, the other categories of interviewees were quizzed based on their responses regarding company policy, role, and responsibility, budget allocation, training requirements, and issues and challenges that the company faces in dealing with environmental compliance.

Based on the interviews with all 14 interviewees from Environmental Control Officers, Environmental Consultants, and Project Proponents, answers tend to zero in on the lack of project proponent commitment and environmental awareness as the main factors that contributed to the non-compliance. They specifically highlighted the attitude and mindset of prioritising project timelines over environmental responsibility. This focus on meeting deadlines led to the implementation of the project without proper control measures, resulting in environmental issues on-site.

This is further supported by the fact that three out of five project proponents acknowledged the absence of environmental policy in the company, none have a specific budget allocation for environmental aspects at the project site. The interviewees also mentioned the lack of a competent Environmental Officer to handle environmental matters on the project site, specifically. Most have main jobs as Safety

and Health Officers or Site Supervisors. They were given additional tasks as Environmental Officers, but lacked a full understanding of their responsibility. This could also be attributed to the lack of specific training for the Environmental Officer, as mentioned by three out of five Project Proponents and the absence of an in-house manual/guideline to implement mitigation measures, as provided by the company, as mentioned by four of them. Other factors such as lack of enforcement, lack of stakeholder engagement, weaknesses of the EIA report, and stringent conditions are only mentioned by the Environmental Control Officer. Table 1 lists potential factors that affect non-compliance as gathered from the interviews.

Findings from the survey

Regarding geographical conditions and the location of the project sites, the survey revealed that respondents identified flat land as the highest condition, with 12 project sites, followed by hilly areas with seven project sites, and a combination of hilly and flat areas with six project sites. Other geographical conditions recorded include swampy and on-slope areas, both of which are present at three project sites, as well as lowland areas at two project sites. Figure 3 shows the survey responses on the geographical conditions of the housing and commercial development activities in Sabah.

Table 1: List of factors affecting non-compliance based on interview responses

Factors Affecting Non-compliance	Interviewees Statements
Lack of project proponent commitment and environmental awareness	<ul style="list-style-type: none"> ▪ Lack of top management commitment and environmental awareness, projects were implemented without proper control measures, a mindset of not being concerned about environmental protection, internal management problems, an attitude of taking things for granted, an absence of the company’s environmental policy, and no specific budget allocation for environmental compliance, misperceptions on EIA approval (mentioned by 5 ECO, 6 EC, and 3PP)
Lack of a competent Environmental Officer (EO)	<ul style="list-style-type: none"> ▪ EO did not understand their role and the content of the environmental conditions. EO overlooked some of the conditions that need to be complied with due to time constraints. EO is less competent and appointed to meet the requirements; EO is not their main job scope (mentioned by 3 ECO and 2 EC)
Lack of training	<ul style="list-style-type: none"> ▪ No specific training for the Environmental Officer in the company (mentioned by 3 PP and 1 EO) ▪ Lack of training providers specifically for the Environmental Officer to understand their role and responsibility (mentioned by 3 PP and 1 EO)
No in-house manual/guideline	<ul style="list-style-type: none"> ▪ No in-house manual/guideline is available to implement mitigation measures (as mentioned by 5 PP and 4 EO)
Other factors	<ul style="list-style-type: none"> ▪ Lack of enforcement by the government (mentioned by 3 ECO) ▪ The EIA study was not comprehensively carried out (mentioned by 2 ECO) ▪ Lack of engagement between stakeholders (mentioned by 2 ECO) ▪ The environmental conditions are too stringent (as noted by 1 ECO) ▪ Nature of the project (short-term in nature) (mentioned by 1 ECO)

ECO = Environmental Control Officer, EC = Environmental Consultant, PP = Project Proponent, EO = Environmental Officer

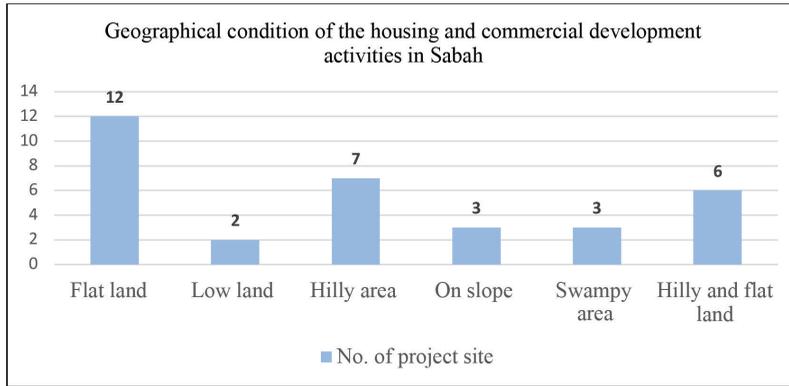


Figure 3: Geographical condition of the housing and commercial development activities in Sabah

Most of the project sites are located within sensitive areas such as adjacent to the beach/ sea (within 100 m from the project site) and adjacent to forest reserve/mangrove as well as highly populated areas near the main road, rural areas, urban/town area, near to residential area (within 500 m and 100 m from project site), near to industrial area (within 500 m from the project site), and near to school/public building.

Examining the distribution of project sites by district in Sabah reveals that most housing and commercial development activities are concentrated on the west coast, with Kota Kinabalu, Tuaran, and Papar having the highest frequency. Figure 4 shows the location of a project site by district in Sabah.

Data on potential factors were gathered through a 5-point Likert scale statement regarding Environmental Consultants, Project Proponents, and Environmental Officers’ opinions on their roles and responsibilities, as well as factors that might affect them. There were divided views on the statements regarding the role and responsibilities of a Project Proponent. 50% (8 out of 16) of the respondents disagreed that their company is less committed to environmental management or has no initiative to implement environmental practices in the project area such as ESR.

44% of them (7 out of 16) also did not agree that Top Management does not have a clear role and responsibility regarding environmental

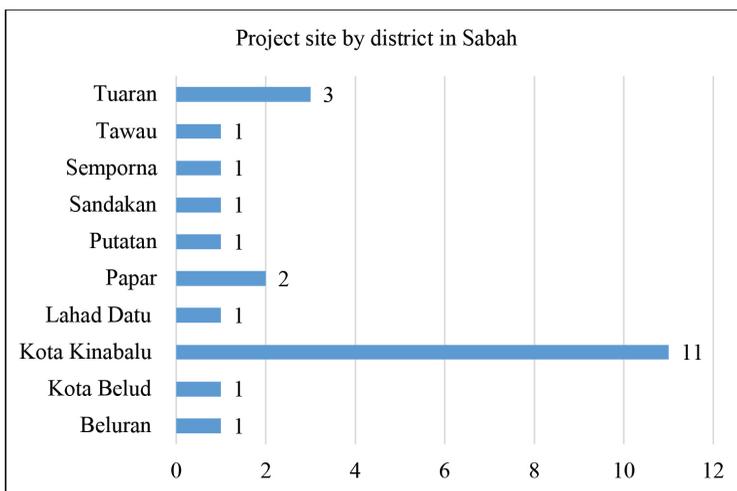


Figure 4: Location of project site by district in this study

management, which contradicted the feedback from the other interviewees. This disagreement demonstrates varied perspectives on project proponents' commitment to environmental management. Figure 5 (a) to (c) shows the responses to the three statements.

The role of Top Management in environmental compliance was asked of the Environmental Officer (EO) to obtain their perspective and perception of the situation in their company. Regarding the statements related to training and development in the company, 50% (3 out of 6) of the EO disagreed that the company lacks in providing training on their role and responsibilities, 67% (4 out of 6) disagreed that their company does not ensure continuous training is provided to improve the competence of the EO. These findings are also consistent with statements made during interviews with the EOs regarding training and development within their company.

67% (4 out of 6) disagreed that the company lacks active involvement or continuous communication with relevant authorities, there needs to be more communication regarding environmental management. These responses showed that there were no major issues relating to the company's external communication with stakeholders. In contrast, the Environmental Control Officer's statement in the interview highlighted a lack of stakeholder engagement as one of the factors contributing to non-compliance with AEC.

Strong disagreement was noted on a statement that the company did not conduct regular monitoring on the implementation of environmental conditions, with four strongly disagreeing and one not agreeing with the statement. There is no indication of budget issues from the respondent's feedback on the statement that the company did not allocate enough budget for environmental management, with 67% (4

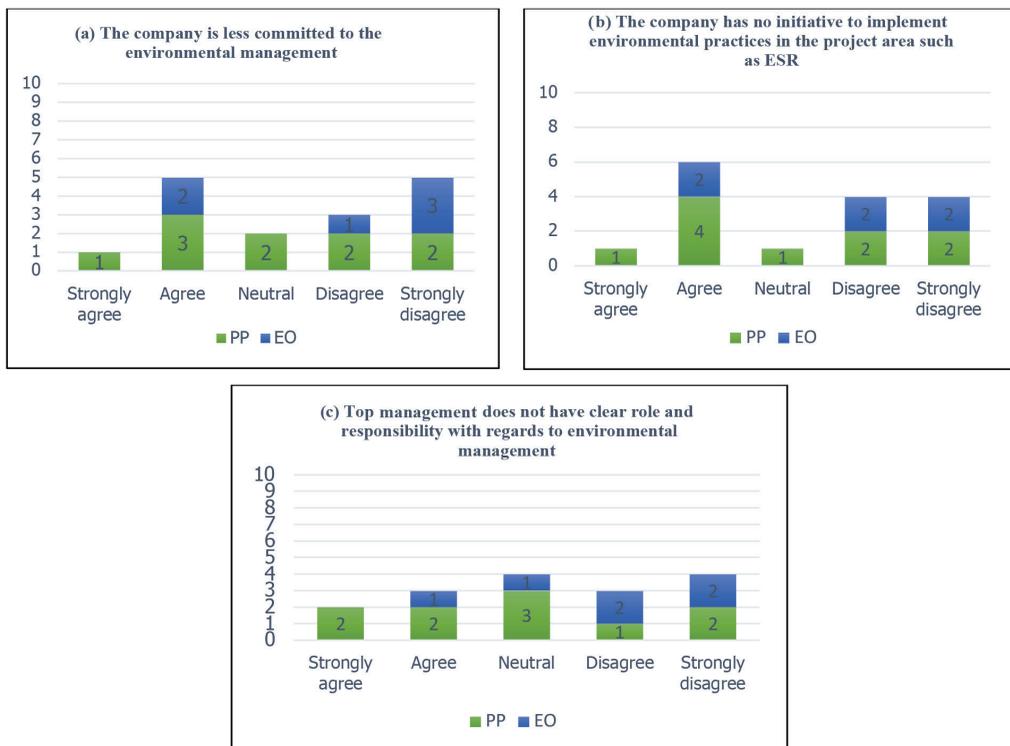


Figure 5: (a) to (c) Survey responses of Project Proponent (PP) and Environmental Officer (EO) related to the role of Project Proponent

out of 6) EOs disagreeing with this statement. It is challenging to gain a clear understanding of the actual perspective on the role of Top Management in environmental compliance due to the limited number of respondents for this category. Figure 6 (a) to (f) showed survey responses from the Environmental Officers on statements related to the role of the Top Management.

Other factors that can contribute to environmental non-compliance are the geographical conditions and the locations of the project sites. 56% (9 out of 16) of the respondents (PPs and EOs) agreed with the two statements on the specific location of the project site and certain geographical conditions that can lead to environmental non-compliance.

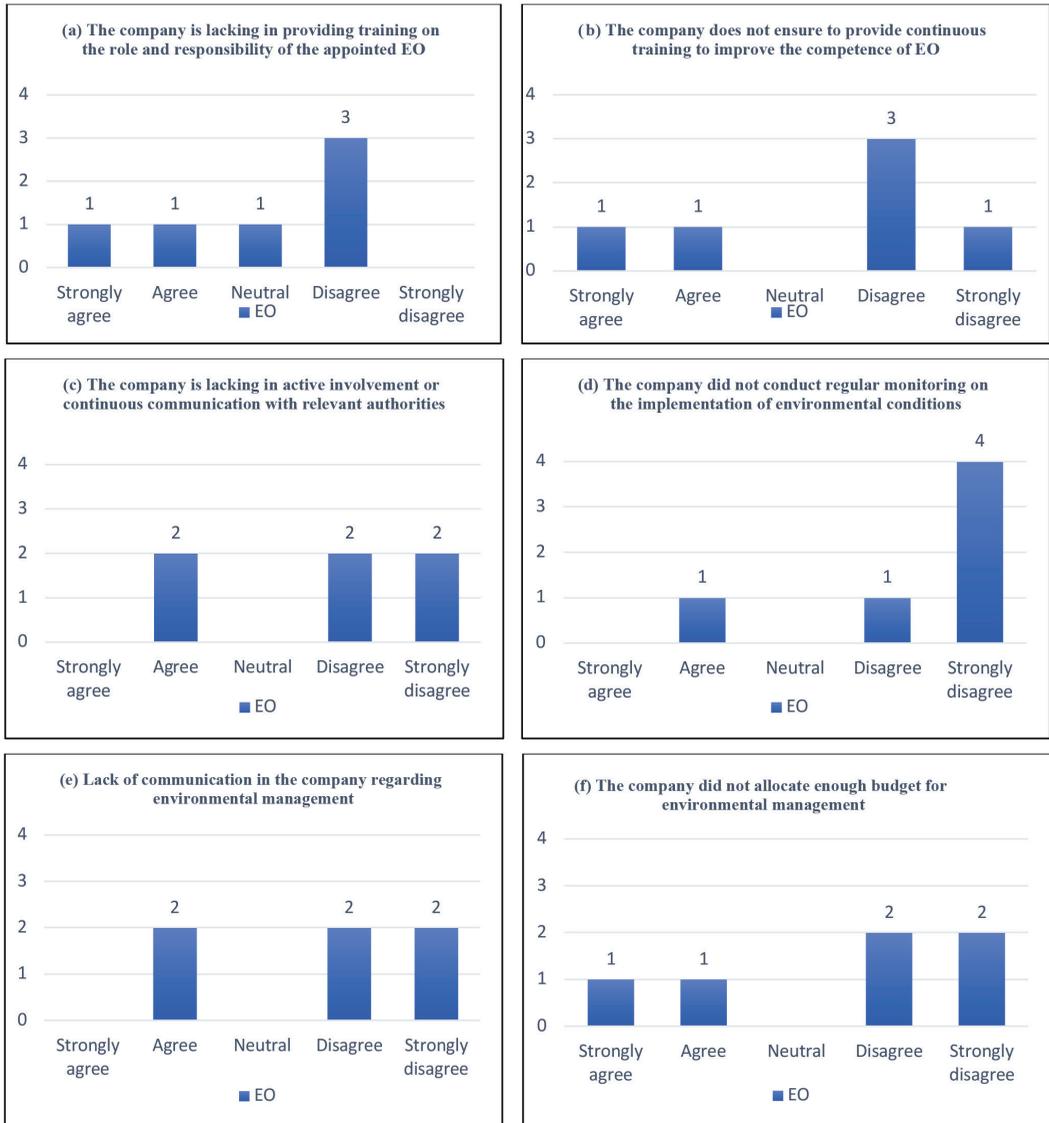


Figure 6: (a) to (f) Survey responses by Environmental Officer (EO) related to the roles of top management

These responses showed that the location of the project sites and geographical conditions can affect the environmental non-compliance. Figure 7 shows the survey responses by Project Proponent and Environmental Officer related to the geographical condition and location of the project site statements.

Discussions

The lack of commitment and environmental awareness among Project Proponents may be a key factor contributing to the company’s poor compliance and performance. This was reflected in several behaviours highlighted by interviewees, including limited budget allocation, failure to provide specific staff training, particularly regarding the roles and responsibilities of the Environmental Officer, and a lack of urgency in addressing environmental issues on-site. Top Management commitment has tremendous trickle-down effects on the organisation to improve organisational environmental performance and probably even employees’ pro-environmental behaviours (Memon *et al.*, 2022; Serrano & Fonseca, 2024).

Project Proponents can enhance their environmental commitment and awareness by adopting voluntary practices such as Environmental, Social and Governance (ESG). Based on the interview, only one company had taken this initiative; this could be prompted by the intention of becoming a publicly listed

company, as environmental commitment is a key requirement for compliance. Another initiative could involve offering incentives to encourage employees and stakeholders to put extra effort into environmental activities (Memon *et al.*, 2022). The government could consider similar approaches by promoting Environmental Self-Regulation (ESR) among project proponents, thereby fostering mutual benefits among stakeholders and addressing the issue.

The interviewees also suggested several initiatives to enhance environmental compliance, primarily emphasising the commitment and support of Project Proponents. These include allocating sufficient budget for implementing mitigation measures, establishing clear environmental goals and policies, understanding the legal implications and consequences of non-compliance, appointing competent Environmental Officers, and forming a dedicated team within the company to manage environmental compliance.

This research has several limitations, including the limited number of survey respondents and the difficulty in recruiting interviewees for the Environmental Officers category. The small sample size makes generalising the findings to the overall sector difficult (Pitt *et al.*, 2009). However, data triangulation has allowed a deeper understanding of the main factors by incorporating different perspectives from various targeted groups through multiple data collection methods.

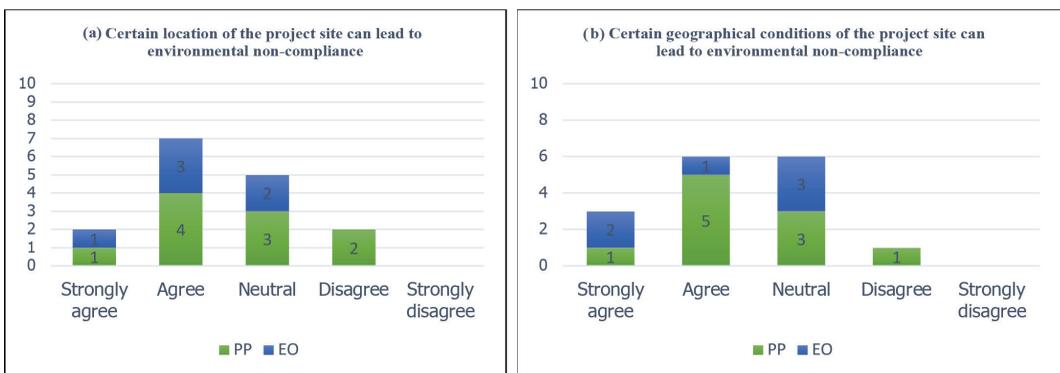


Figure 7: (a) and (b) Responses of Project Proponent (PP) and Environmental Officer (EO) on the geographical condition and location of the project site statements

The reasons for the lack of participation in the interview could be attributed to concerns over their job security while others have tight work schedules. By increasing the number of respondents and making minor adjustments to the study's design and scope, future research can be enhanced. This type of research can be extended to other developmental activities in Sabah, allowing for a broader understanding of the challenges and issues across various sectors.

Conclusions

Most of the respondents, both from the interview and online surveys agreed that the project proponent's lack of environmental awareness and commitment towards environmental compliance, specifically on their attitude, budget allocation, training and development of their staff, lack of competent Environmental Officer, and lack of enforcement are the main factors affecting the non-compliance and inconsistent submission of ECR. Other factors contributing to this issue include an incomplete EIA study, weaknesses in environmental conditions, and insufficient stakeholder engagement. The findings of this study serve as a guide for the government to strengthen the current mechanism and system for monitoring and managing the level of compliance with environmental conditions specific to residential and commercial development, as well as other activities of a similar kind.

Acknowledgements

The authors extend their gratitude to everyone involved in this study, to the Environment Protection Department, especially Mr. Vitalis J. Moduying, the Director of the Environment Protection Department, Sabah for the permission to conduct this research and for the full support in sharing useful information and granted data accessibility throughout this research. This research has been partially funded by the state government of Sabah. This research is part of a dissertation, which was submitted as one of the fulfilments to meet requirements for the Master at Universiti Malaysia Sabah.

Conflict of Interest Statement

The authors declare that they have no conflict of interest.

References

- Akadiri, P. O., & Fadiya, O. (2013). Empirical analysis of the determinants of environmentally sustainable practices in the UK construction industry. *Construction Innovation, 13*(4), 352-373.
- Caro-Gonzalez, A. L., Nita, A., Toro, J., & Zamorano, M. (2023). From procedural to transformative: A review of the evolution of effectiveness in EIA. *Environmental Impact Assessment Review, 103*, 107256.
- Chew, W. C., & Vun, L. W. (2013). Preliminary ecological input assessment of EIAs of selected quarries and oil palm plantation projects in Sabah, Malaysia. *Journal of Sustainability Science and Management, 8*(1), 22-31.
- Chua, Y. P. (2016). *Mastering research methods* (2nd ed.). Malaysia: McGraw-Hill Education (Malaysia) Sdn Bhd.
- Chua, Y. P. (2020). *Mastering research statistics* (2nd ed.). Malaysia: McGraw-Hill Education (Malaysia) Sdn Bhd.
- Dai, L., Han, Q., de Vries, B., & Wang, Y. (2022). Exploring key determinants of willingness to participate in EIA decision-making on urban infrastructure projects. *Sustainable Cities and Society, 76*, 103400.
- Department of Environment (DOE). (1974). Environmental Quality Act 127. <https://www.doe.gov.my/en/environmental-quality-act-1974-act-127-2/>
- Department of Environment (DOE). (2015). Environmental Quality (Prescribed Activities) (Environmental Impact Assessment) Order 2015. <https://www.doe.gov.my/en/eia-prescribed-activities-environmental-quality-order-2015/>

- Environmental Protection Department (EPD). (2002). State of Sabah Environment Protection Enactment (EPD) 2002.
- Environmental Protection Department (EPD). (2005). State of Sabah Environment Protection (Prescribed Activities) Orders 2005.
- Environment Protection Department (EPD). (2021). Standard Operating Procedures (SOPs) for Compliance with Environmental Conditions of Housing and Commercial Development in Sabah. Sabah: EPD.
- Environment Protection Department (EPD). (2021). Environmental Self-Regulation (ESR) Guideline in Compliance with Environmental Conditions for Housing and Commercial Development Activities in Sabah. EPD.
- Environmental Protection Department (EPD). (2023). Handbook on Environmental Impact Assessment in Sabah. EPD.
- Guo, M., Xu, Y., & Chen, Y.D. (2019). Environmental enforcement and compliance in Pennsylvania's Marcellus shale gas development. *Resources, Conservation & Recycling*, 144, 24-31.
- Johnson, R. B., & Christensen, L. (2016). *Educational research* (5th ed.). SAGE Publications.
- Kelley, K., Clark, B., Brown, V., & Sitzia, J. (2003). Good practice in the conduct and reporting of survey research. *International Journal for Quality in Health Care*, 15(3), 261-266.
- Lyhne, I., van Laerhoven, F., Cashmore, M., & Runhaar, H. (2017). Theorising EIA effectiveness: A contribution based on the Danish system. *Environmental Impact Assessment Review*, 62, 240-249.
- Malaysia Federal Constitution. (1957). *Federal Constitution of Malaysia*. Attorney General's Chambers of Malaysia. <https://lom.agc.gov.my/federal-constitution.php>
- Memon, S. B., Rasli, A., Dahri, A. S., & Hermilinda Abas, I. (2022). Importance of Top Management Commitment to Organisational Citizenship Behaviour towards the environment, green training and environmental performance in Pakistani industries. *Sustainability*, 14(17), 11059.
- Ministry of Science, Technology and The Environment, Malaysia (MOSTE). (2002). National Policy on The Environment. <https://www.doe.gov.my/en/national-policy-of-the-environment/>
- Ministry of Tourism, Culture and Environment (MTCE). (2017). Sabah State Policy on the Environment, MTCE.
- Moduying, V. J. (2007). *The effectiveness of EIA Process and Procedure in Sabah: Views of Environmental Consultants*. Kota Kinabalu: Universiti Malaysia Sabah.
- Morgan, R. K. (2012). Environmental impact assessment. *The State of The Art*, 30(1), 5-14.
- National Environmental Policy Act (NEPA. GOV). (2023). <https://ceq.doe.gov/index.html>
- Pitt, M., Tucker, M., Riley, M., & Longden, J. (2009). Towards sustainable construction: Promotion and best practices. *Construction Innovation*, 9(2), 201-224.
- Serrano, A. M., & Fonseca, A. (2024). License to pollute? A longitudinal analysis of environmental performance, compliance, and enforcement in 232 licensed projects in Brazil. *Journal of Cleaner Production*, 434, 139977.
- Swangiang, K. (2018). Comparative review of EIA in the Association of Southeast Asian Nations. *Environmental Impact Assessment Review*, 72, 33-42.
- Tang, D. K. H. (2019). The dilemma of environmental impact assessment in Sarawak, Malaysia. *Journal of Sustainability Science and Management*, 14(3), 3-6.
- United Nations. (2015). 15 General Assembly of the United Nations, Resolution adopted

- by the General Assembly on 25 September 2015, GA Res 17/1, UN GAOR, 17th sess, 93rd plen mtg, Agenda Item 15 and 116, UN Doc A/RES/70/1 (25 September 2015, adopted 21 October 2015) para 1-3.
- United Nations. (2022). The 17 goals. <https://sdgs.un.org/goals>
- United Nations. (1987). Report of the World Commission on Environment and Development: Our Common Future. <https://sustainabledevelopment.un.org/content/documents/5987our-common-future.pdf>
- United States Environmental Protection Agency. (2023). National Environmental Policy Act (NEPA). <https://www.epa.gov/nepa/what-national-environmental-policy-act>
- Vicente-Molina, M., Fernández-Sainz, A., & Izagirre-Olaizola, J. (2018). Does gender make a difference in pro-environmental behaviour? The case of the Basque Country University students. *Journal of Cleaner Production*, 176, 89-98.
- Yusof, N., Awang, H., & Iranmanesh, M. (2017). Determinants and outcomes of environmental practices in Malaysian construction projects. *Journal of Cleaner Production*, 156, 345-354.
- Zhang, J., Kørnøv, L., & Christensen, P. (2013). Critical factors for EIA implementation: Literature review and research options. *Journal of Environmental Management*, 114, 148-157.