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ANNALS OF Environmental Science and Toxicology OPEN ACCESS JOURNAL

ISSN: 2641-2969 DOI: https://dx.doi.org/10.17352/aest

Literature Review

Industrial entrepreneur's perception of greenhouse gas emission and its impact in Vientiane Capital, Lao PDR

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Received: 23 May, 2023
Accepted: 13 June, 2023
Published: 14 June, 2023

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Keywords: GHG emission; Entrepreneur's perception; Environmental problems; Laos

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Abstract

Laos ranked 8th in terms of total greenhouse gas emissions among ASEAN countries, with 17.9 million metric tons of carbon dioxide equivalent (MtCO2e) emissions. The energy sector was responsible for the majority of emissions, accounting for about 50% or 8.9 MtCO2e, followed by the agriculture sector at around 35% or 6.3 MtCO2e, and other sectors at approximately 15% or 2.7 MtCO2e (The Global Carbon Atlas reported, 2018). This study investigates greenhouse gas emissions and environmental issues among industrial entrepreneurs in Vientiane Capital, Lao PDR. Data was collected by using questionnaires and face-to-face interviews were conducted with participants from 80 different plants in Vientiane Capital between January 25 and March 20, 2018. It identifies various environmental problems caused by industrial plants, emphasizing the need for specific pollution source mitigation and sustainable waste management. The study reveals significant impacts on health and living conditions, highlighting the urgency for proactive measures. Climate variations, alterations in seasons, and intensified storms are identified as major contributors to violence levels. Strategies proposed by entrepreneurs include accurate measurement methods, pollution treatment systems, improved power efficiency, renewable energy adoption, an environmental protection organization, and efficiency enhancements in logistics and transportation. The study emphasizes the role of government, plant owners, and the general population in addressing CO2 emissions through collective efforts. Overall, it provides valuable insights and calls for proactive measures, stakeholder engagement, and diverse strategies for sustainability in Vientiane Capital and Laos.

Introduction

Greenhouse Gases (GHGs) are gases that trap heat in the Earth's atmosphere, causing the greenhouse effect and climate change. The primary GHGs consist of Carbon Dioxide (CO2), Methane (CH4), Nitrous Oxide (N2O), and fluorinated gases. These emissions are predominantly generated by human activities, including the burning of fossil fuels, deforestation, industrial processes, and agricultural practices. Major concerns associated with GHG emissions encompass climate change, increased carbon dioxide levels, methane emissions, deforestation, industrial activities, and agricultural practices. The accumulation of GHGs in the atmosphere has led to a rise in global temperatures, resulting in climate change. This phenomenon brings various negative impacts such as higher sea levels, more frequent extreme weather events, altered precipitation patterns, and disruptions to ecosystems. Carbon dioxide, primarily released through fossil fuel combustion, is the largest contributor to GHG emissions. Elevated levels of CO2 in the atmosphere lead to ocean acidification, affecting marine ecosystems and organisms dependent on coral reefs and shellfish. Methane, a potent GHG, is emitted during the production and transportation of coal, oil, and natural gas, as well as from livestock, agricultural practices, and organic waste decay in landfills. Methane contributes to both climate change and poor air quality. Deforestation, which involves clearing forests for agriculture, logging, and urbanization, releases significant amounts of CO2 into the atmosphere. Deforestation not only reduces the Earth's capacity to absorb CO2 but also diminishes biodiversity and disrupts ecosystems.

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Industrial activities such as manufacturing, mining, and construction produce GHG emissions through fossil fuel combustion, chemical reactions, and the release of fluorinated gases. These emissions contribute to global warming and air pollution. Agricultural practices like enteric fermentation (the digestive process in livestock), rice cultivation, and the use of synthetic fertilizers also contribute to GHG emissions. Nitrous oxide, another potent GHG, is released from fertilized soils and animal waste.

Numerous countries have successfully implemented various actions to address climate change and Greenhouse Gas (GHG) issues. For example, several European countries, including Germany, Denmark, and Sweden, have made successful transitions to a greater share of renewable energy sources like wind and solar power. Additionally, the European Union's Emissions Trading System (EU ETS), the world's largest carbon market, has effectively reduced greenhouse gas emissions by placing a price on carbon and promoting emission reduction efforts. Amsterdam and Copenhagen have also implemented extensive cycling infrastructure, reducing car dependency and promoting sustainable transportation methods.

In the United States, the implementation of Renewable Portfolio Standards (RPS) has mandated a specific percentage of electricity generation from renewable sources, thereby reducing reliance on fossil fuels. Various states and cities have introduced energy efficiency programs that encourage the adoption of energy-efficient technologies in buildings, appliances, and transportation. Organizations like the Northeast Regional Greenhouse Gas Initiative (RGGI) have successfully established a cap-and-trade program for power plants, leading to emission reductions and investments in clean energy projects.

China has emerged as a global leader in renewable energy investment, significantly expanding its solar and wind power capacities and making substantial investments in electric vehicle infrastructure. China has also initiated large-scale afforestation projects, such as the "Great Green Wall," to combat desertification and sequester carbon dioxide. Furthermore, China has committed to reaching the peak of its carbon dioxide emissions by 2030 and achieving carbon neutrality by 2060, demonstrating its intent to transition towards a low-carbon economy.

A statement mentioned above, reducing greenhouse gas emissions is a global challenge. In order to fulfill its obligations under the Paris Agreement on climate change, the Lao government has established a target of decreasing its greenhouse gas emissions by 20% before the year 2030. Laos ranked 8th in terms of total greenhouse gas emissions among ASEAN countries, with 17.9 million metric tons of carbon dioxide equivalent (MtCO2e) emissions. The energy sector was responsible for the majority of emissions, accounting for about 50% or 8.9 MtCO2e, followed by the agriculture sector at around 35% or 6.3 MtCO2e, and other sectors at approximately 15% or 2.7 MtCO2e (The Global Carbon Atlas reported, 2018).

The city of Vientiane is the focal point of the country's development, particularly in the industrial sector, as evidenced by the increasing influx of investment from both domestic and foreign sources. However, this growth in industrial production has led to environmental challenges, as the CO2 emissions released during the manufacturing process have become a cause for concern. Therefore, the current study aims to investigate the industrial entrepreneur's perception of greenhouse gas emissions in Vientiane Capital, Lao PDR, regarding the impact of greenhouse gas emissions. It also intends to evaluate the environmental issues associated with plants and their impacts. Additionally, the study seeks to identify a viable approach to reduce CO2 emissions and pinpoint the primary entity responsible for tackling this issue. Finally, the research provides recommendations to the government on managing CO2 emissions and the critical implementer.

Literature review

This section provides a review of previous studies that have examined stakeholders' perceptions of climate change and GHG issues in different countries. Additionally, it suggests policies that have been proposed to cope with these problems. The findings from these studies shed light on the understanding and perspectives of various stakeholders, including government officials, policymakers, businesses, and the general public, regarding climate change and GHG mitigation measures.

According to a study by Muhammad Awais, et al. [1], while there is significant awareness about climate change and its impacts in Pakistan, there is a limited understanding of greenhouse gas emissions and their role in contributing to climate change. The study highlights that education, income, and media exposure are crucial in shaping people's attitudes toward climate change and greenhouse gas emissions. The authors suggest that targeted education and awareness-raising campaigns can improve public understanding of these issues and encourage sustainable behaviors.

In the Philippines, farmers possess knowledge about climate change and its effects, but their understanding of Greenhouse Gas (GHG) emissions and their contribution to climate change is limited. Nevertheless, farmers exhibit a favorable attitude towards implementing practices that can decrease GHG emissions. However, the lack of information and resources impedes their ability to do so, as noted by Carpio, et al. [2]. Meanwhile, although many Americans believe that climate change is happening and is human-induced, much doubt and skepticism still exist regarding the issue. The general public has identified various methods for mitigating climate change, such as renewable energy and carbon capture and storage. Still, it recognizes potential obstacles to their adoption, according to Leiserowitz, et al. [3]. The research conducted by Weber and Stern (2011) investigated the connection between the public's opinions on climate change, greenhouse gas emissions, and their support for policies designed to reduce emissions in the United States. The study revealed that the public's beliefs about the root causes and seriousness of climate change, as well as their confidence in scientists and institutions, were significantly related to their backing for policies aimed at

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alleviating climate change. Additionally, the study found that people's views on the effectiveness and fairness of different policy measures impacted their support for these policies. The authors suggested that enhancing public comprehension of climate change and its outcomes, as well as providing clear information about policy alternatives, could enhance public support for mitigation measures.

According to Poortinga, et al. [4], Australians showed worry over climate change and greenhouse gases but lacked a deep comprehension of the scientific principles associated with them. They depended more on their personal experiences to make judgments. To overcome the gap between scientific knowledge and public perception regarding climate change and greenhouse gases, additional education and engagement programs are necessary. Isaac Luginaah, et al. [5], many Ghanaians know about climate change. Still, there are noteworthy deficiencies in their understanding of the root causes, consequences, and prospective solutions to the issue. The research suggests that for Ghana to implement effective climate policies, there needs to be a boost in public awareness and education about climate change and greenhouse gas mitigation methods.

Carmichael, et al. [6] emphasize that sociocultural factors shape the public's beliefs regarding climate change and greenhouse gas emissions. Factors such as social norms, political ideology, and personal experiences can significantly influence perceptions. It is essential to comprehend these factors to create efficient policies that aim to tackle climate change and diminish greenhouse gas emissions.

The release of greenhouse gases (GHG) is a major contributor to climate change and has been a cause for concern in recent decades. One proposed solution is an environmental tax, which is explored in this literature review. Numerous studies have shown a connection between GHG emissions and environmental tax. Baranzini, et al. (2017) found that CO2 emissions taxes were the most effective policy tool for reducing GHG emissions, followed by energy consumption taxes and fossil fuel use taxes. Several factors, such as the demand for energy, the level of taxation, and the availability of alternative energy sources influence the effectiveness of environmental taxes. Hsu, et al. (2018) examined the impact of a carbon tax on GHG emissions in China and found that it could reduce emissions by up to 18% by 2030. Moreover, it could have a positive impact on economic growth in the long run by encouraging the use of cleaner energy sources.

In summary, the public's awareness and understanding of climate change and greenhouse gas emissions across different countries, including Pakistan, the Philippines, the United States, Australia, and Ghana, suggest that education, income, media exposure, personal experiences, and sociocultural factors shape people's attitudes and perceptions towards climate change and its causes. Moreover, the potential effectiveness of environmental taxes as a solution to reduce greenhouse gas emissions. Overall, the studies highlight the importance of enhancing public awareness and education about climate change and its impacts to encourage sustainable behaviors and support effective policy measures.

Methodology

Population and sample

According to the Ministry of Industry and Trade [7], Vientiane Capital has a total of 2,736 plants, comprising 84 large plants, 186 medium plants, and 2,466 small plants. The factory industries in Vientiane are classified based on their greenhouse gas emissions, with a total of 351 plants, including 30 large plants, 112 medium plants, and 209 small plants. The population used in this study are industrial plants in Vientiane Capital total of 351 in 9 districts by using Proportional Stratified Random Sampling as follows (Table 1).

The study focuses on industrial plants operating in food and beverage, metal, processing, plastics, and other industries. The majority of these plants fall under the Small and Medium Enterprise (SME) classification, indicating their smaller size. It is important to note that in the Lao PDR, however, there is currently no clearly established classification system specifically for GHG emissions. To address this, the study classifies the industrial plants into three categories based on the number of workers: small size (with fewer than 50 workers), medium size (with 50-99 workers), and large size (with more than 100 workers). This worker-based categorization provides a practical approach to classify the plants in the absence of a specific GHG classification system.

Data collection

In this research, data were collected through the use of questionnaires, which were divided into three main sections. The first section focused on obtaining general information about the plants, such as their establishment year, location, investment type, industrial type, number of employees, average monthly income, and other related details. The second section aimed to identify the environmental problems caused by each plant and their impacts. Finally, the third section aimed to explore the industrial entrepreneurs' perception and understanding of greenhouse gas emissions and their impact, their approaches to reducing greenhouse gas emissions and their impact, as well as the key organizations involved in addressing these problems. Face-to-face interviews were

Table 1: Shows the number of industrial plants in Vientiane's Capital.

Districts	Industries (plant)	Samples
Chanthabouly	35	8
Sikhodtabong	49	11
Xaysedtha	31	7
Sisattanark	48	11
Naxaiythong	17	4
Xaythany	92	21
Hardxaiyfong	74	17
Sangthong	1	0
Parknguem	4	1
Total	351	80

Source: Ministry of Industry and Trade [7].

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conducted with participants from 80 different plants in Vientiane Capital between January 25 and March 20, 2018.

Data analysis

In the process of analyzing the gathered data, various statistical techniques were employed to derive meaningful insights and draw valuable conclusions. One of the fundamental methods used was descriptive statistics like percentages, which are commonly used to summarize and describe data.

To evaluate the environmental impact of the plants, the entrepreneur was presented with a range of options regarding the environmental issues caused by their operations. These options encompass the release of wastewater, noise pollution, generation of garbage, air pollution, emission of unpleasant odors, and the utilization of chemicals in their production processes. The assessment of the environmental impact depends on the responses provided by the entrepreneurs (more detail please, see the Supplementary Information part) [8-15].

Results

General information about plants

Table 2 presents plants' years of operation, 20 plants fall into the 5 - 10 years and 11 - 16 years groups, each representing 25% of the sample size. However, 14 plants (17.50%) have been in existence for more than 23 years. Table 2 also includes the location of plants, with 13 (16.25%) located inside special economic zones and 67 (85.75%) located outside. Out of the total sample size, 42 plants (52.50%) are 100% Lao-owned, 24 plants (30%) are 100% foreign-owned, and the remaining are joint ventures.

In terms of industry types, the processing industry represents 20.00% of the sample size with 16 plants. Food and beverage, metal, and plastic industries have slightly different numbers and percentages, while 33 plants (41.25%) fall under other industries such as electronics. Only 12 plants (15.00%) among the total sample size release CO2 emissions.

Most plants (47.50%) have a small number of employees (less than 50), while 27 plants (33.75%) are categorized as large. In terms of the monthly income, out of the total sample size, 34 plants (42.50%) have a monthly income less than or equal to 5,000,000,000 Lao Kip, while 18 plants (22.50%) have an income between 5,000,000,001 and 10,000,000,000 Lao Kip. Overall, the majority of plants (about 65%) have a monthly income less than or equal to 10,000,000,000 Lao Kip

Table 2: General information about plants.

Number of years of operations		
<5	13	16.25
5 – 10	20	25.00
11 – 16	20	25.00
17 – 22	13	16.25
>23	14	17.50
Location		
Inside special economic zones	13	16.25
Outside special economic zones	67	85.75
Ownership		
Lao owned 100%	42	52.50
Joint venture with foreign-owned < 50%	5	6.25
Joint venture with foreign-owned > 50%	9	11.25
Foreign Owned 100%	24	30.00
Types of Industry		
Food and beverage industry	10	12.50
Metal industry	10	12.50
Processing industry	16	20.00
Plastic industry	11	13.75
Other industry	33	41.25
Number of employees		
<50 (small size)	38	47.50
50 – 99 (medium size)	15	18.75
>100 (large size)	27	33.75
The income per month (Lao Kip)*	Numbers of plants	percent (%)
<=5,000,000,000	34	42.50
5,000,000,001 – 10, 000,000,000	18	22.50
10,000,000,001 – 15,000,000,000	14	17.50
>15,000,000,00	14	17.50
Total	80	100 (%)

Source: authors calculated (2018);
*Remark: 1 USD = 8.530 Lao Kip (LAK), the official exchange rate in 2018.

Environmental problems caused by plant and their impacts

Environmental problems caused by plants: The study focused on identifying and analyzing the different environmental problems caused by industrial plants in Vientiane's Capital. The research determined the number of plants that had issues in each category and the percentage of the total number of plants surveyed. The study revealed that garbage was the primary environmental problem encountered by industrial plants, with 86.25% or approximately 69 plants reporting this issue. The second significant environmental issue was noise pollution, affecting 81.25% or approximately 65 plants. The use of chemicals was reported as a problem by 58.75% or approximately 47 plants. Wastewater release and air pollution were reported as issues with the same percentage of 53.75% or approximately 43 plants. The release of bad smells was identified as a problem by 48.75% of the plants. Overall, all 80 plants surveyed had at least one environmental problem, with the percentage of facilities affected ranging from 48.75% to 86.25%. These results highlight the need for proactive measures to address these problems and ensure the sustainability of industrial operations (Table 3).

The study examined further the environmental problems in each category caused by industrial plants. Starting from wastewater release, 83.72% of the respondents in this category reported that they created less degree of issue. While 13.95% of the respondents reported that they created a moderate degree of wastewater, only 1.25% reported a high degree of the issue.

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Table 3: Environmental problems caused by plants.

Issues	Number of plants with environmental problems	Percent
Release wastewater	43	53.75
Noise pollution	65	81.25
Garbage	69	86.25
Air pollution	43	53.75
Release bad smell	39	48.75
Using chemical	47	58.75
Total	80	100

Source: Authors calculated (2018);

It appears that a majority of the respondents in this category perceived their noise pollution as having a relatively low degree of issue, with 64.62% reporting that they created less of an issue. However, a sizable minority of 21.74% of respondents reported a moderate degree of issue, and a smaller minority of 13.04% reported a high degree of issue.

For the garbage, the study found that the majority of the respondents in this category created a low degree of an issue with respect to 65.22%. However, a significant proportion of respondents, 30.77%, reported a moderate degree of garbage, indicating that there is still some room for improvement in reducing waste. Only a small minority of 4.62% of respondents reported a high degree of the issue, suggesting that severe garbage problems are not as widespread in this category.

The study found that the majority of the respondents in this category created a low degree of air pollution, with 72.09% reporting that they created less of an issue. However, a minority of respondents, 13.95%, reported a moderate degree of air pollution, indicating that there may be some air quality issues that need to be addressed. Similarly, another minority of 13.95% reported a high degree of the issue, suggesting that air pollution is a significant problem for a small proportion of the respondents in this category.

For the bad smells category, the study found that the majority of the respondents created a low degree of an issue with respect to the release of, with 71.97% reporting. However, a minority of respondents, 20.51%, reported a moderate degree of bad smell problem, indicating that there may be some unpleasant odors that need to be addressed. Similarly, another minority of 7.69% reported a high degree of the issue, suggesting that bad smells are a significant problem for a small proportion of the respondents in this category.

It appears that the majority of the respondents in the chemicals used category reporting to a low degree of problem, with 59.57% reporting that they created less of an issue. However, a significant proportion of respondents, 31.91%, reported a moderate degree of use of chemicals in their production, indicating that there may be some potential risks associated with chemical use. Only a small minority of 8.51% of respondents reported a high degree of the issue.

In summary, wastewater by industrial plants is not a significant issue and its severity may vary depending on the specific context and circumstances of each plant. While many plants owner may not see noise pollution as a major problem. Sustainable waste management practices are having a positive effect on reducing garbage, but there is still some work to be done in this area. It is recommended to continue promoting environmentally-friendly practices like recycling and reducing waste to further reduce the impact of garbage on the environment. The plants' owner does not view air pollution as a major issue from their plants, but the study highlights specific sources of air pollution that need to be addressed from industrial emissions or other local sources. Addressing specific sources of bad smells, such as sewage systems, garbage disposal, and industrial emissions, is also necessary. Although the majority of respondents do not cause significant issues related to chemical use, there are still concerns about the use of safer chemicals and reduce exposure to harmful chemicals. Monitoring and regulating the use of chemicals in industry is also important to prevent potential harm to workers and the environment (Figure 1).

Impact of environmental problems: The analysis section focused on examining the various impacts of environmental issues stemming from industrial plants in Vientiane's Capital. The findings of the study highlighted the significant effects on the health of workers, which was reported by approximately 71.25% or 57 plants, ranking it as the top concern. The second notable impact was on the living conditions of the local population, affecting approximately 53.75% or 43 plants. The impacts on the health of individuals in the surrounding area, land degradation, and plants and animals showed slight variations, at approximately 43.75%, 42.50%, and 41.25% respectively. In conclusion, the study underscores the urgent need for proactive measures and policies to address the significant impacts of environmental problems caused by industrial plants in Vientiane Capital. Efforts should be directed towards safeguarding the health of workers and improving the living conditions of local residents in the surrounding area (Figure 2) (Table 4).

Industrial entrepreneur's perceptions

Perception on CO2 emission: In this particular section of the study, the plant owners were interviewed to gather their opinions on the most significant impacts of CO2 emission. They

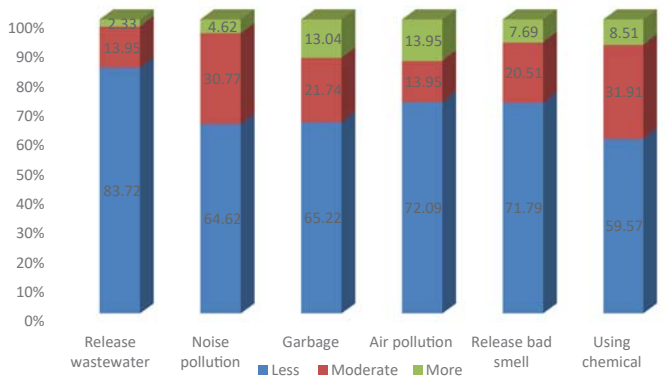

Figure 1: Degree of environmental problems created by plants.
Source: Authors calculated (2018).

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were presented with a range of environmental consequences resulting from the rise in greenhouse gas emissions and were asked to rank their top three severe cases from the provided options. The choices included climate variations (such as temperature changes), alterations in seasons, intensified storms, degradation of natural resources, flooding, drought, deforestation-induced erosion, loss of biodiversity, and health issues (such as epidemic diseases).

Table 5 illustrates the relationship between CO2 emissions and the severity levels of violence which are categorized as follows: 1 for the least severe, 2 for a moderate level, and 3 for the most severe (worst). These severity levels are associated with different environmental consequences. The data reveals that climate variations have the highest impact on violence levels, with 38 cases (47.5%) recorded at level 1, 14 cases (17.5%) at level 2, and 5 cases (6.25%) at level 3. Alterations in seasons come in second, with 6 cases (7.5%) at level 1, 17 cases (21.25%) at level 2, and 13 cases (16.25%) at level 3. Intensified storms follow, with 13 cases (16.25%) at level 1, 16 cases (20%) at level 2, and 15 cases (18.75%) at level 3. Natural resource degradation ranks fourth, with 15 cases (18.75%) at level 1, 14 cases (17.5%) at level 2, and 12 cases (15%) at level 3. Flooding, drought, deforestation-induced erosion, loss of biodiversity, and health issues follow with varying impact levels. The total number of cases for all categories is 80 (100%) at all three levels. In summary, measures should be taken to reduce CO2 emissions, particularly those that contribute to climate variations and alterations in seasons, which have the highest impact on violence levels. Additionally, efforts should be made to raise awareness about the negative consequences of CO2 emissions on the environment and human health and encourage plants to take action to mitigate the impact of CO2 emissions on the environment and reduce the associated levels of violence.

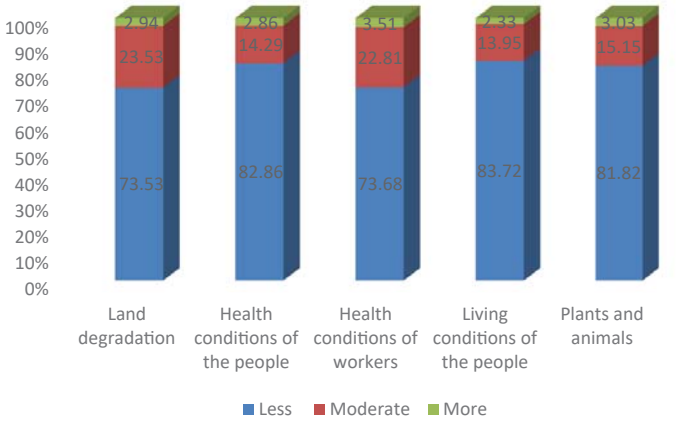

Figure 2: Shows the degree of impact caused by industrial plants.
Source: Authors calculated (2018).

Table 4: Number of plants and the list of environmental impacts.

Impact on	Number of plants that create impact	Percent
Land degradation	34	42.5
Health conditions of the people	35	43.75
Health conditions of workers	57	71.25
Living conditions of the people	43	53.75
Plants and animals	33	41.25
Total	80	100

Source: Authors calculated (2018).

Table 5: CO2 emission impacts on the environment.

CO2 emission impacts	Level of violence		
	1	2	3
Climate variations	38 (47.5%)	14 (17.50%)	5 (6.25%)
Alterations in seasons	6 (7.50%)	17 (21.25%)	13 (16.25%)
Intensified storms	13 (16.25%)	16 (20%)	15 (18.75%)
Natural resources degraded	15 (18.75%)	14 (17.5%)	12 (15%)
Flooding	0 (0%)	1 (1.25%)	3 (3.75%)
Drought	2 (2.50%)	7 (8.75%)	7 (8.75%)
Deforestation-induced erosion	1 (1.25%)	5 (6.25%)	4 (5%)
Loss of biodiversity	1 (1.25%)	2 (2.5%)	8 (10%)
Health issues	4 (5%)	4 (5%)	13 (16.25%)
Total	80 (100%)	80 (100%)	80 (100%)

Source: Authors calculated (2018).

Perception of approach to reduce CO2 emission: This section presents the viewpoints of entrepreneurs in the industrial sector regarding their strategies for reducing CO2 emissions in Vientiane Capital and Laos as a whole. The responses are depicted in Table 6, where the majority of respondents of 56.25% expressed their approval of developing accurate methods to measure CO2 emissions in different industries. At the same time, a significant percentage of 51.25% believed that mandating pollution treatment systems for all plants would be a crucial step forward. Furthermore, 43.75% supported initiatives aimed at improving the efficient use of electric power in businesses, industries, and households, with the goal of optimizing energy consumption and promoting sustainability across various sectors.

In contrast, 36.25% of the participants showed their endorsement of replacing conventional fuel sources with renewable energy alternatives such as solar and wind power, which would result in a significant reduction in greenhouse gas emissions. On a broader scale, 30% of the respondents advocated for establishing a dedicated organization solely focused on environmental protection. This organization would be responsible for devising and implementing strategies to combat different environmental issues. Additionally, a noteworthy percentage of 28.75% agreed that the primary responsibility for providing pollution treatment systems should lie with the government. Opinions regarding the reduction of CO2 emissions varied. Roughly 27.25% of the participants favored substituting coal and oil with natural gas as an effective means of mitigating CO2 release into the atmosphere. Another key aspect that received attention was efficiency. Among the participants, 25% emphasized the importance of enhancing efficiency in logistics and transportation operations to minimize energy waste and reduce carbon emissions associated with these activities.

Perception of key actors to cope with CO2 emission: This section presents the viewpoints of industrial entrepreneurs regarding the key actors involved in addressing CO2 emissions.

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The survey categorized these key actors into various groups based on their roles, such as the government, plant owners, people living near industrial plants, all people in Vientiane Capital, and others. The distribution of respondents and their respective percentages in each group are as follows:

Out of the total respondents, 30 plants (37.50%) expressed the view that the government should be the key actor in solving CO2 emissions. Additionally, a substantial proportion of respondents, consisting of 25 plants (31.25%), believed that plant owners should take the lead in addressing CO2 emissions. On the other hand, 21 plants (26.25%) considered the entire population of Vientiane Capital as the key actor in coping with CO2 emissions.

Conversely, a small percentage of respondents, represented by 2 plants (2.50% of the total), believed that individuals living near industrial plants and other actors should play a key role in addressing CO2 emissions.

In summary, there is a diversity of opinions regarding the key actors involved in tackling CO2 emissions. Different groups consider the government, plant owners, and the general population of Vientiane Capital as important actors. Overall, these findings highlight the need for a collective effort involving various stakeholders to effectively address CO2 emissions and work towards a more sustainable future (Table 7).

Discussion

The study on identify and examine the diverse environmental challenges associated with industrial plants in Vientiane Capital. By conducting thorough research and collecting relevant data, it was established that each and every plant surveyed had encountered at least one environmental problem. This significant discovery serves to underscore the far-reaching impact of industrial activities on the environment, highlighting the pressing need for immediate action to address these issues. Furthermore, the study aligns with previous research that has unequivocally demonstrated the inherent link between industrial activities, climate change, and Greenhouse Gas (GHG) emissions. The identification of environmental issues within industrial plants serves as a stark reminder of the urgent requirement for proactive measures and strategies to effectively confront these challenges and ensure the long-term sustainability of industrial operations. Potential measures may encompass the adoption of cleaner production technologies, the implementation of sustainable waste management practices, the enhancement of energy efficiency, and the promotion of renewable energy sources. By taking proactive measures, industrial plants can actively mitigate their environmental impact, diminish their carbon footprint, and contribute to a more environmentally sustainable future. Moreover, the study's findings lend support to the notion that environmental stewardship and sustainable practices should be integral to industrial operations. By placing a premium on environmental responsibility and integrating sustainable practices into their day-to-day activities, industrial plants can minimize their adverse effects on the environment and play a vital role in safeguarding natural resources for future generations [16-20].

Table 6: Shows the Approach to reducing CO2 emission options.

Approach to reducing CO2 emission options	Plants (%)
Identify methods to measure CO2 emissions in various industries	45 (56.25%)
Mandatory for all plants to install pollution treatment systems	41 (51.25%)
Pollution treatment systems are the government's responsibility	23 (28.75%)
Substituting coal and oil with natural gas to reduce CO2 emission	22 (27.25%)
Using solar energy and wind power as an alternative power	29 (36.25%)
Establishing an organization dedicated to environmental protection	24 (30 %)
Preserve forests and restore degraded forest areas	41 (51.25%)
Enhancing efficiency in logistics and transportation operations	20 (25 %)
Enhancing the efficient use of electric power in business, industry, and households	35 (43.75%)

Source: Authors calculated (2018).

Table 7: Key actors to cope with CO2 Emission.

Key actor	Plants	Percent (%)
Government	30	37.50
Plant's owner	25	31.25
People who live nearby	2	2.50
All people in Vientiane Capital	21	26.25
Other	2	2.50
Total	80	100

Source: Authors calculated (2018).

The study focused on gathering the viewpoints of entrepreneurs in the industrial sector to understand their strategies for reducing CO2 emissions in Vientiane Capital. One of the key findings highlighted the importance of raising awareness about the detrimental effects of CO2 emissions on the environment and human health. This indicates a pressing need to educate and inform both industry stakeholders and the general population about the negative consequences of excessive CO2 emissions. Moreover, the study emphasized the urgency of encouraging industrial plants to take proactive measures in mitigating the impact of their CO2 emissions on the environment. This aligns with the findings of previous studies conducted by Porting, et al. [4], Carpio, et al. [2], and Muhammad Awais, et al. [1]. These studies have also underscored the significance of implementing strategies and adopting technologies to reduce CO2 emissions and combat climate change. By referencing these previous studies, the current research further strengthens the argument for immediate action to be taken to curb CO2 emissions. The findings from Porting, et al., Carpio, et al., and Muhammad Awais, et al.[1,2,4] provide additional support and credibility to the conclusions drawn in the present study regarding the need for proactive measures and strategies to address CO2 emissions in Vientiane Capital [21-22].

Conclusions and recommendations

In conclusion, this study focused on investigating the industrial entrepreneurs' perception of greenhouse gas emissions in Vientiane Capital, Lao PDR, and the environmental

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issues associated with plants. The results highlight the following key findings:

The study examined environmental issues caused by industrial plants in Vientiane's Capital. It found that each plant had at least one environmental problem. However, the main was garbage issues. The study provides insights into the environmental problems caused by industrial plants in different categories. It indicates that wastewater release is perceived as a relatively low issue, while noise pollution, garbage, air pollution, and bad smells have varying degrees of impact. Although the majority of respondents reported low levels of concern in each category, there are still areas that require attention and improvement. This includes addressing specific sources of pollution, promoting sustainable waste management practices, and reducing air pollution from industrial emissions and local sources. These findings emphasize the importance of taking proactive measures to address these issues and ensure the sustainability of industrial operations.

The health of workers was identified as the most affected caused by plants, followed by the living conditions of the local population, the health of individuals in the surrounding area, land degradation, and plants and animals also showed notable effects. These findings emphasize the urgent need for proactive measures and policies to address these impacts. Priority should be given to safeguarding the health of workers and improving the living conditions of local residents.

Climate variations were ranked as having the highest impact on violence levels, when, examined the opinions of plant owners regarding the most significant impacts of CO_2 emissions, followed by alterations in seasons and intensified storms. However, natural resource degradation, flooding, drought, deforestation-induced erosion, loss of biodiversity, and health issues also had varying impacts. The findings emphasize the need for measures to reduce CO_2 emissions, particularly in relation to climate variations and alterations in seasons. It is crucial to raise awareness about the negative consequences of CO_2 emissions on the environment and human health and encourage industrial plants to take action in mitigating the impact of CO_2 emissions.

The study reveals several strategies suggested by industrial entrepreneurs to reduce CO_2 emissions in Vientiane Capital and Laos. Key proposals include developing accurate measurement methods for CO_2 emissions and mandating pollution treatment systems for all plants. Additionally, improving electric power efficiency, adopting renewable energy sources, establishing an environmental protection organization, and enhancing efficiency in logistics and transportation are also deemed important. To achieve CO_2 emission reduction and promote sustainability, it is recommended that the government prioritize the development of accurate measurement methods for CO_2 emissions while implementing the other proposed approaches in parallel.

The study reveals that the government, plant owners, and the general population of Vientiane Capital are identified as important actors in addressing the CO_2 emissions problem. These findings emphasize the importance of collective efforts and the involvement of multiple stakeholders in effectively addressing CO_2 emissions.

References

1. Awais M, Shah AQ, Zubair M, Ahmad T, Raza SH. Public perception of climate change and greenhouse gas emissions in a developing country: a case study of Pakistan. Environmental Science and Pollution Research. 2021; 1-14. DOI: 10.1007/s11356-021-14467-3.

2. Carpio CE, Rejesus RM, Knight TO. Climate change and greenhouse gas perception: an empirical study of farmers in the Philippines. Climatic Change. 2012; 113(2):285-299. https://link.springer.com/article/10.1007/s10584-011-0355-4

3. Leiserowitz A, Edward W. Connie Roser-Renouf M, Rosenthal SA, Kotcher J. Public Perception of Climate Change and Mitigation Technologies: A Survey of Climate Change Beliefs and Attitudes in the United States. Yale University and George Mason University, 2014. https://www.climatechangecommunication.org/wp-content/uploads/2014/03/2014-Climate-Beliefs-March.pdf

4. Poortinga W, Spence A, Whitmarsh L, Capstick S, Pidgeon N. Climate change and greenhouse gas perception in the Australian Community: An exploratory study. Journal of Environmental Psychology. 2011; 31(4):339-347.

5. Luginaah I, Laar AK, Selormey EE, Tenkorang EY. Public perception of climate change and mitigation strategies in Ghana: Implications for climate policy. Climate Policy. 2016; 16(8):1000-1017.

6. Carmichael J, Brulle RJ, Jenkins JC. Perception of climate change: The role of socio-cultural factors in shaping risk perceptions and policy preferences. Journal of Environmental Policy & Planning. 2017; 19(4):485-503. doi: 10.1080/1523908X.2016.1237913

7. Ministry of Industry and Trade. Statistics of industrial activities conducted in 2014. Retrieved from Department of Industry and Crafts. 2014. (7 May 2016).

8. Bostrom A, Morgan MG, Fischhoff B, Read D. What do people know about global climate change? 1. Mental models. Risk Analysis. 1994; 14(6): 959-970.

9. Hong-Xia D, Yan-Li L, Yan L. Willingness to Pay for CO2 Emissions Reduction: A Case Study from Four Provinces, China. Public. 2014.

10. Jue E. Analysis of Greenhouse Gas Emissions Reduction Opportunities and Marginal Abatement Costs of the Energy Intensive. 2014.

11. Williams G. Households Willingness to Pay for the Emissions Reduction Policy, Queensland, Australia. 2015.

12. Haliciogla. An Econometric Study of CO2 Emission, Energy Consumption, Income and Foreign Trade in Turkey. Energy Policy. 2009; 37:1156-1164.

13. Jalil. Environment Kuznets Curve for CO2 Emission: A Cointegration Analysis for China. Energy Policy. 2009; 37:5167-5172.

14. Diederichy JH, Goeschlz T. Willingness to Pay for Individual Greenhouse Gas Emissions Reductions: Evidence from a Large Field Experiment. Heidelberg University. 2011.

15. Holmes KJ. Modeling the economics of greenhouse gas mitigation. The National Academies Press. 2011.

16. Franco G, Perduri R, Murolo A. Effetti biologici da esposizione occupazionale a campi magnetostatici utilizzati in imaging a risonanza magnetica nucleare: una rassegna [Health effects of occupational exposure to static magnetic fields used in magnetic resonance imaging: a review]. Med Lav. 2008 Jan-Feb;99(1):16-28. Italian. PMID: 18254536.

17. Khaosaart M. Economic instruments for environmental management. Economic environment. 2009.

Citation: Inthakesone B, Kingkhambang K, Syphoxay P, Singhalath P, Phavongxay S, et al. (2023) Industrial entrepreneur's perception of greenhouse gas emission and its impact in Vientiane Capital, Lao PDR. Ann Environ Sci Toxicol 7(1): 034-042. DOI: https://dx.doi.org/10.17352/aest.000068

18. Ministry of Natural Resources and Environment. And the importance of greenhouse gas. 2014. http://www.Environnet.in.th (3 March 2015).

19. Ministry of Natural Resources and Environment. Greenhouse gas emissions of ASEAN. 2014. http://www.Environnet.in.th (3 March 2015).

20. Phouphet KYOPHILAVONG. Carbon Emissions and Trade Openness in Lao PDR: An ARDL Application for Cointegration. National University of Laos. 2008.

21. Soukhalom R. Compare how the book value of our products in the market. Journal of Economics Natural. 2541; 16(4):89-115.

22. Weber EU, Stern PC. Public Perceptions of climate change and Support for mitigation policies in the United States. Climatic Change. 2011; 108(4):417-430. DOI: 10.1007/s10584-011-0212-7.

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