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Illegal Oil Well Mitigation: Environmental Sustainability: Strengthening the Oil and Gas Accounting Information System

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Abstract:
This study focuses on exploring aspects of illegal mining in the Musi Banyuasin area, South Sumatra Province-Indonesia. The research includes green accounting, human resources, sustainable environment, and oil and gas accounting information systems. This study uses a qualitative descriptive approach with an exploratory method to explore the phenomenon in detail. Data were obtained through structured interviews, field observations, focus group discussions (FGDs), and supporting document reviews. The collected data were analyzed thematically to identify, review, and report findings based on interviews. The results of the study indicate that the application of green accounting practices, human resource management, and the use of accounting information systems in the oil and gas sector are important foundations for creating a sustainable environment. Sustainable environments not only support economic aspects but also social, cultural, and ecological aspects. This research implies that it contributes to the preservation of green vegetation, reducing greenhouse gas emissions and environmental damage. Theoretically, this research provides insight into the theoretical benefits of green environmental sustainability.

Keywords: *Green Accounting, Human Resources, Environment Continuity, Oil and Gas Accounting Information System.*

Abstrak:
Penelitian ini berfokus pada eksplorasi aspek penambangan ilegal di wilayah Musi Banyuasin, Provinsi Sumatera Selatan-Indonesia. Penelitian meliputi akuntansi hijau, sumber daya manusia, lingkungan berkelanjutan, dan sistem informasi akuntansi migas. Penelitian ini menggunakan pendekatan deskriptif kualitatif dengan metode eksploratif untuk mengeksplorasi fenomena secara detail. Data diperoleh melalui wawancara terstruktur, observasi lapangan, diskusi kelompok terfokus (FGD), dan telaah dokumen pendukung. Data yang terkumpul dianalisis secara tematik untuk mengidentifikasi, mengkaji, dan melaporkan temuan berdasarkan wawancara. Hasil penelitian menunjukkan bahwa penerapan praktik akuntansi hijau, pengelolaan sumber daya manusia, dan penggunaan sistem informasi akuntansi di sektor migas merupakan landasan penting dalam menciptakan lingkungan yang berkelanjutan. Lingkungan yang berkelanjutan tidak hanya mendukung aspek ekonomi tetapi juga aspek sosial, budaya, dan ekologi. Implikasi dari penelitian ini adalah kontribusi terhadap pelestarian vegetasi hijau, pengurangan emisi gas rumah kaca, kerusakan lingkungan. Secara teoritis, penelitian ini memberikan wawasan tentang manfaat teoritis, yaitu keberlanjutan lingkungan hijau.

Kata Kunci: Akuntansi Hijau; Sumber Daya Manusia; Lingkungan Keberlanjutan; Sistem informasi Akuntansi Migas.

INTRODUCTION

The government faces many problems and challenges of increasingly complex natural habitat destruction related to sustainability and environmental responsibility. In this sector, the oil and gas industry environment is at the forefront. These challenges have an impact on plant damage, which threatens flora and fauna and reduces biodiversity, natural disasters, landslides, greenhouse gases, and damages greenery (Masudin et al., 2024). The importance of a sustainable environment, green accounting synergy, and oil and gas accounting information systems are not only efficient but sustainable in order to save generations in the long term. To address the problems of environmental sustainability and human safety, law enforcement policies and local government regulations (Mohammad et al., 2024).

Problems arise in society due to economic pressures, low human resources, and difficult employment opportunities (Ram í rez-Orellana et al., 2023). Local governments have economic, legal, moral, and social responsibilities. According to stakeholder theory, local governments have an important role in taking action. Stakeholder involvement greatly supports efforts to prevent environmental damage in order to maintain the sustainability of the green economy. This goal is to maintain the preservation of nature for future generations (Handayani & Maharani, July 2021).

In the 2018-2024 academic year period, 144 illegal mines caused ecosystem damage and hampered the sustainability of environmental reports. This condition indicates a discrepancy with legal provisions, especially Government Regulation Number 47 of 2012, concerning the social and environmental responsibilities of local governments. This regulation requires local governments to prepare annual reports and sustainability reports. Many things influence the emergence of economic pressures in society, such as low education and high prices for living necessities, as well as the emergence of environmental losses reaching trillions of rupiah. Based on South Sumatra police records, there are around 10 thousand illegal oil wells in Muba Regency (Gerged et al., 2024)

The problem of illegal oil is detrimental to the environment and human safety. The Muba Government has not been able to handle the revision of the Regulation of the Minister of Energy and Mineral Resources (ESDM) Number 1 of 2008 concerning guidelines for the utilization of petroleum mining in old wells optimally. Meanwhile, the concept prepared includes work safety and environmental governance, as well as service contracts and cooperation agreements (Antonini & Gomez-Conde, 2024). Urgency in the context of the sustainability performance of illegal oil mining in Indonesia will cause an unsustainable green environment for future generations in the long term. In order to adopt regulatory compliance, the legal and financial risks associated with environmental violations must be reduced in order to measure the protection of the forest environment as a whole, especially in terms of green accounting and the environment (Chenet, 2024). According to the expectations of the government and GIRI, the concept of environmental sustainability can be implemented well with government-based environmental governance, human resources who care about environmental issues, and effective resources (Gerged et al., 2024).

Local governments have an important role in supporting environmental performance through decision-making involving stakeholders. Companies often show a commitment to a green environment and high sustainability accounting as the main factors that investors consider in making investment decisions (Antonini & Gomez-Conde, 2024). Human resources can be optimized through the evaluation of the oil and gas sector accounting information system. The evaluation program can also be applied in the context of sustainability accounting.

Research conducted by (Azzolina et al., 2016) shows an influence between green accounting and the performance of oil and gas accounting information systems on information disclosure. However, in contrast to the results of research by (Azzolina et al., 2016), green accounting was found to have no significant effect on the disclosure of oil and gas accounting information systems. Local governments can disclose information through various communication channels, such as the Internet, newspapers, and television. Information conveyed by local governments also functions as a monitoring mechanism that provides psychological influence to the community.

Through the Internet media, it is hoped that the public can access information about the oil and gas accounting system that has been conveyed transparently. Research by (Chenet, 2024) discusses the influence of environmental sustainability on the oil and gas accounting information system and its disclosure. However, the results of this study contradict the study by (Mohammad et al., 2024), which shows that media exposure has no effect on corporate social responsibility (CSR) disclosure. Various backgrounds and previous studies have examined the role of local government by considering relevant factors. However, the results of this study still require further consistency. Therefore, re-examination is needed using relevant samples to evaluate the relationship between environmental sustainability and oil and gas accounting information systems. This study aims to provide evidence on how the performance of oil and gas accounting information systems, environmental sustainability, and human resources are affected by non-cyclical illegal mining sector activities.

According to the theory of oil and gas accounting information systems, local governments have a responsibility to respond to public concerns regarding risks related to green accounting. Currently, green accounting is increasingly developing and is starting to be applied in various business sectors. The oil and gas accounting information system focuses on environmental aspects, including ecosystem damage, soil and water pollution, and greenhouse gas emissions (Widiastuti et al., 2024). In this context, green accounting, human resources, and environmental sustainability are interrelated elements. Local governments need three main dimensions in human resource management to support sustainability, namely competence, motivation, and physical health. Stakeholder theory, first introduced by Freeman in 1984 (Kivits et al., 2021), explains the responsibilities of local governments towards stakeholders. These stakeholders include the community, government, creditors, suppliers, and shareholders (Pratama & Ghozali, 2022). This theory is based on the concept of mapping stakeholders, where the party responsible is the local government.

Local governments have obligations to their stakeholders, and disclosure of environmental damage is one form of communication carried out. This includes aspects of the environment, human resources, environmental sustainability, and social performance. Stakeholders have the capacity to influence the oil and gas accounting information system, both positively and negatively, depending on their interests and power. Furthermore, several studies highlight the importance of integrating ecological, economic, and social dimensions in the characteristics of green accounting as an integral part of the oil and gas accounting information system (Masudin et al., 2024).

The oil and gas accounting information system will not only affect society in the future but also impact the quality of human resources today. Therefore, good implementation of this system can result in positive and sustainable investment for the safety of society and the ecosystem (Ben Moussa & El Arbi, 2020). The implementation of an effective oil and gas accounting information system can support the achievement of consistently high performance. On the other hand, ineffective illegal oil mining practices indicate weak management of green accounting, human resources, environmental sustainability, and oil and gas accounting information systems, which ultimately lead to stakeholder dissatisfaction. According to recent research, one of the main challenges faced in the context of illegal mining in Indonesia is the high dependence of society on weak governance and the low quality of human resources in rural areas (Ansari et al., 2024). Previous research also found that the impact of green accounting on the development of oil and gas accounting information systems is still minimal (Hilmawan et al., 2023).

To create shared value and achieve sustainability goals, illegal oil mining must prioritize good management, supervision, and accountability. This is in line with previous studies that emphasize the importance of implementing an effective oil and gas accounting information system to maintain stakeholder trust and support the sustainability of the biological ecosystem (Cho & Patten, 2013).

Other studies show that strong institutions that implement green accounting are essential to ensure long-term sustainability. Good implementation of oil and gas accounting information systems can help strengthen stakeholders' trust in environmental sustainability performance (Chang et al., 2024). Thus, illegal oil mining, green accounting, human resources, environmental sustainability, and oil and gas accounting information systems play an important role in ensuring performance

sustainability. Previous studies have shown that illegal oil mining practices bring various challenges to environmental sustainability, which have a significant impact on the implementation of green accounting (Alnowibet et al., 2021).

Figure 1. Oil and Gas Accounting Aspects

RESEARCH METHODS

Research Design

This descriptive study adopted a qualitative approach with explorative characteristics and a comprehensive description of bad incidents that have happened (Tiwari & Khan, 2020). This study focused on a single case analysis, which aims to gain an in-depth understanding of events, activities, and processes that are limited in scope and involve one or more individuals (Alnowibet et al., 2021). The study used a single case study approach, as suggested by (Adly & El-Khouly, 2022), to explore in depth the system or "case" that includes events, activities, and processes defined in a particular context. Referring to Law Number 36/PUU-X/2012, it was stated that the regulations relating to the Constitution of the Republic of Indonesia no longer have applicable legal force. In this situation, the functions and duties of the Oil and Gas Executive Agency are temporarily transferred to the government through the relevant ministries until new regulations are formed to regulate this matter. Musi Banyuasin Regency in South Sumatra Province was chosen as the location for this single case study. The selection of this location is based on the high incidence of illegal oil well explosions that endanger life safety, ecosystem damage due to plants that fail to grow optimally, and river pollution due to oil spills over the past four years. This study aims to reveal the reality on the ground in order to formulate relevant solutions in maintaining the sustainability of the green environment and ensuring the safety of communities involved in illegal oil mining activities, which are often influenced by economic pressures and low quality human resources (Edeh et al., 2023).

Data Collection

Data collection was conducted through structured personal interviews, field observations, focus group discussions, and supporting document analysis. The determination of informants in this study was carried out in two stages. The first stage is the selection of key informants using the purposive sampling method, which is based on certain criteria, such as community involvement in forest reforestation efforts and direct contributions to the development of oil and gas accounting information systems. Key informants in this study have an important role in reducing the number of victims due to illegal oil well explosions. Namely, the respondents in this study were illegal miners and communities around the illegal oil well locations who were affected by environmental pollution, such as damage to forest ecosystems and river water pollution that cannot be used for household needs carried out through in-depth and measurable interviews about the impact of illegal oil well activities.

The second stage includes identifying supporting informants using the snowball sampling method, which is carried out based on information obtained from key informants. Supporting informants in this study include local government officials and law enforcement officers who are relevant to the problems studied. This study uses thematic analysis to identify, evaluate, and convey the data obtained (Braun & Clarke, 2006). This analysis approach was chosen because of its easy-to-apply and flexible nature, which is in line with the characteristics of qualitative descriptive research. The thematic analysis process was carried out through the following stages:

Data Analysis

This study used thematic analysis to identify, evaluate, and convey the data obtained (Braun & Clarke, 2006). This analysis approach was chosen because of its easy-to-apply and flexible nature, which is in line with the characteristics of qualitative descriptive research. The thematic analysis process was carried out through the following stages:

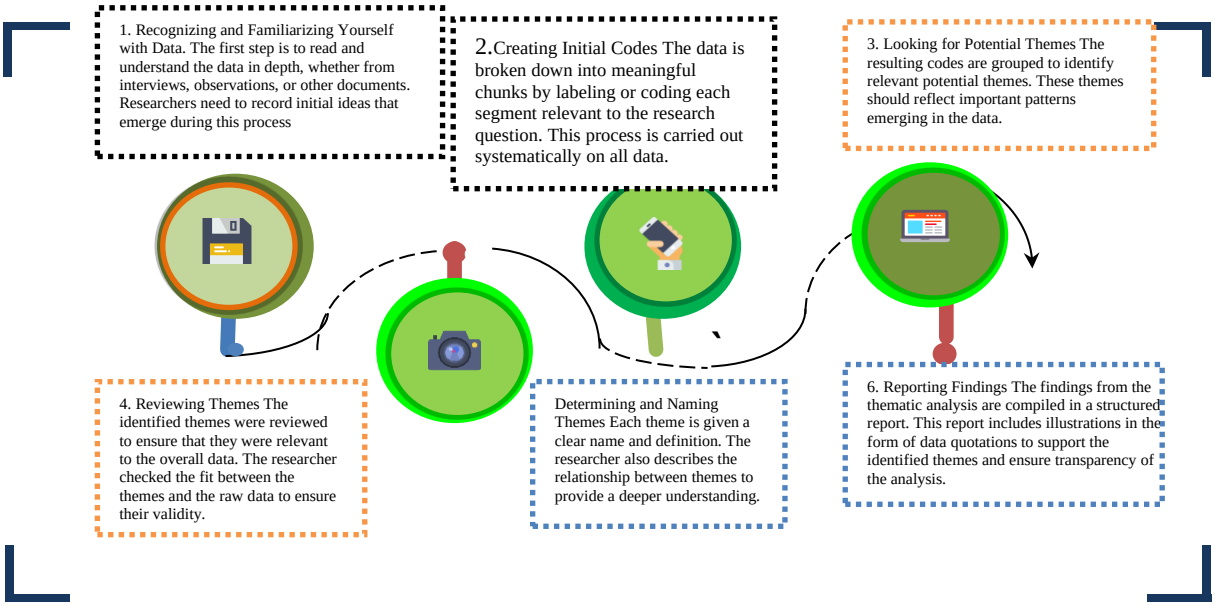

Figure 2. Research Analysis Stage

RESULTS AND DISCUSSION

The results were discovered by inspecting empirical data findings on green accounting, human resources (HR), environmental sustainability, and oil and gas accounting information systems, illegal oil mining in Musi Banyuasin district, South Sumatra Province, Indonesia, based on informant interviews. The illegal oil threshold oil and gas accounting information system includes a set of procedures, technologies, and resources designed to record, analyze, and report financial data related to the oil and gas sector. This system includes essential elements that support transparency, efficiency, and regulatory compliance in the oil and gas industry.

1. **Procedure**

   Empirical procedures such as data analysis and surveys are effective in evaluating the success of green accounting, human resources, environmental sustainability, and oil and gas accounting information systems. The main obstacles are resistance to change, high technology costs, and the lack of uniform green accounting regulations. Strengthening human resource training, developing sustainability regulations, and cross-sector collaboration are needed to support green innovation.

2. **Technology**
   Technology has been proven to strengthen the implementation of green accounting, human resource management, and environmental sustainability efforts and support data-driven decision-making. High technology implementation costs, resistance to change, and data security risks are major barriers. Companies need to invest in technology training, improve data security, and develop cross-sector collaboration for more cost-effective, innovative solutions.

3. **Designed Resources**
   Specially designed resources, such as training and technology, effectively support green accounting, human resource management, and environmental sustainability. The cost of developing resources, lack of training, and limited infrastructure are major obstacles. Companies need to increase investment in green resources, human resource development, and system integration to create long-term value.

4. **Take Notes**
   The process of recording, analyzing, and checking data supports the successful implementation of green accounting, human resource development, and environmental sustainability. Key barriers include technology costs, resistance to change, and lack of supportive regulations. Companies need to improve system integration, expand human resource training, and adopt more comprehensive sustainability standards for better results.

5. **Analyze**
   Empirical data analysis supports the implementation of green accounting, human resource development, and sustainability strategies, providing a solid basis for decision-making. Key challenges include resource constraints, high technology costs, and resistance to change. Companies need to strengthen technology-based training, integrate information systems comprehensively, and prioritize sustainability standards.

6. **Reporting Financial Data**
   Integration of green accounting and environmental sustainability data into financial statements enhances corporate credibility. The lack of uniform reporting standards and the cost of implementing information systems are major obstacles. The adoption of international sustainability reporting standards and the development of technology are needed to improve reporting accuracy and efficiency.

This section discusses the results of studies on green accounting, environmental sustainability human resources, oil and gas accounting information systems, and illegal oil mining in the Musi Banyuasin district of South Sumatra Province, Indonesia. Illegal oil wells do illegal drilling, with a high risk of a fire explosion occurring, then damaging the natural environment and damaging river flows.

1. **Governance well oil illegal in Musi Banyuasin Regency-Muba**
   Communities in Musi Banyuasin Regency, South Sumatra Province, are often involved in illegal oil drilling. This activity is carried out without valid permits from the government or relevant authorities and is often carried out in a very dangerous manner. This illegal oil drilling is carried out by community groups who exploit oil reserves in the area without paying attention to environmental impacts or occupational safety. This activity is high risk, especially with the possibility of fires or explosions that can cause major losses and damage the surrounding environment. Poor governance in the management of illegal oil wells in Musi Banyuasin Regency has a very negative impact on the environment, occupational safety, and natural resource management. The lack of implementation of green accounting, minimal human

resource training, and the absence of an adequate information system hinder sustainability and transparency. To overcome this, efforts are needed to introduce stricter regulations, implement good governance principles, and involve communities in environmental and occupational safety awareness to create legitimate and sustainable oil drilling practices.

2. **Technology**
   Technology refers to the tools, systems, and techniques used to support human activities in various sectors, including oil drilling. In the context of illegal oil wells found in Musi Banyuasin Regency, the technology used is often very limited and does not meet safety or sustainability standards. Communities that carry out illegal drilling generally rely on simple and non-standardized equipment, which increases the risk of accidents, fires, or explosions. This also contributes to greater environmental damage, such as soil and water pollution, that damages river flows and surrounding ecosystems. The technology used in illegal oil drilling in Musi Banyuasin Regency is very primitive and unsafe, high risk to worker safety and damaging the environment. The lack of implementation of appropriate technology, green accounting, and transparent information systems makes the management of natural resources and environmental impacts very poor. Efforts are needed to introduce safer and more efficient technology, as well as strengthen the governance system and HR training so that legal and sustainable oil drilling activities can be carried out.

3. **Designed Resources**
   The resources designed in the context of illegal oil drilling by the community refer to the planning and utilization of natural resources, humans, and existing technology to support these activities. In this case, the resources designed are often informal and non-standardized because these activities are carried out illegally. Although these activities involve natural resources (oil) and labor (human resources), careful planning and effective management are almost non-existent. Therefore, illegal oil drilling activities that occur in Musi Banyuasin Regency, South Sumatra, ignore many aspects that should exist in sustainable governance. The resources designed for illegal oil drilling activities in Musi Banyuasin Regency show very limited management, both in terms of nature, human resources, and technology. Lack of mature planning, the absence of adequate green accounting, and low awareness of environmental sustainability worsen the impact of illegal drilling. Therefore, more comprehensive reforms are needed in natural resource management, strengthening human resource capacity, and implementing more environmentally friendly and safe technologies to create more sustainable and legitimate drilling practices.

4. **Take Notes**
   Recording in the context of illegal oil wells by the community refers to the process of recording and documenting oil drilling activities carried out illegally in Musi Banyuasin Regency, South Sumatra. These activities are often undetected by the government or authorities, so the recording of economic, environmental, and social impacts is almost non-existent. However, organized and transparent recording should provide a clearer picture of the impacts of these illegal activities and assist authorities in planning preventive or mitigating actions. Recording illegal oil drilling activities, especially related to green accounting, human resources, environmental sustainability, and accounting information systems, is essential to manage and mitigate the impacts of these activities. Without transparent and systematic recording, the economic and environmental impacts of illegal oil drilling will continue to threaten human safety and ecosystem sustainability. Therefore, efforts are urgently needed to introduce a better recording system, both for the sake of worker safety, environmental management, and transparency in the economic activities carried out.

5. **Analyze**
   Analyzing in the context of illegal oil wells carried out by the community in Musi Banyuasin Regency, South Sumatra, means assessing the impacts, risks, and factors that influence these illegal activities, both in terms of green accounting, human resources (HR), environmental sustainability, and accounting information systems. These illegal drilling activities are carried out without official permits and have the potential to cause severe environmental damage and increase safety risks for workers and the surrounding community. The following is an analysis related to the various aspects involved.

6. **Reporting Financial Data**
   To report financial data related to illegal oil mining in Musi Banyuasin Regency, South Sumatra, involving green accounting, human resources, environmental sustainability, and accounting information systems. Report the costs of environmental damage due to illegal drilling, such as soil and water pollution, as well as the costs of natural recovery and restoration. Record the number of workers, risky working conditions, and costs related to community safety and welfare. Identify and report long-term impacts on ecosystems and river flows, and costs required for environmental mitigation or restoration. Use an accounting system to record income, illegal operating costs, and losses due to environmental damage and provide accurate information to authorities for further action. This report must combine financial elements and social and environmental impacts transparently for evaluation and follow-up.

The research studied the cause of an illegal oil well fire in Musi Banyuasin due to illegal mining causing many deaths. This has been happening for decades. The solution is why the local government does not make regional regulations in controlling illegal oil mines so as to prevent the large number of lives lost due to the eruption of fire from illegal oil wells, namely bursts of fire that spread everywhere. Not only are lives lost, but all the nearby forests are also burned (Arya et al., 2020).

The study offers law enforcement policies for local government regulations on the importance of a sustainable environment, green accounting synergy, and mandatory oil and gas accounting information systems, especially in areas where illegal oil wells are practiced. This research was carried out by 20 people, with the criteria being a minimum duration of five years, having assets of at least IDR 1 billion, a maximum turnover of IDR 2 billion per year, and a collaborative team digging illegal oil wells of at least six people. Data collection was carried out using the saturation point method, where researchers asked all illegal miners the same questions, such as understanding accounting and business, how to record accounting, understanding the risk of fire explosions causing well fires, efforts that have been and will be made to strengthen business foundations, as well as the desire to change professions to green and environmental accounting.

Additional interviews were done with other respondents, namely illegal miners, and communities affected by illegal mining activities.

1. What is your view regarding the implementation of green accounting in the oil and gas sector, especially those affected by illegal oil well activities?
2. Does the local government have a policy related to mitigating the environmental impacts of these illegal activities?
3. How do these activities affect human resources, especially local workers, and forest damage and waste pollution in the environment?
4. Regarding environmental sustainability, what steps have been taken by the local government?
5. Talking about the accounting information system, how do these illegal activities affect the transparency of local government data?
6. Has the way to mitigate the problem of illegal oil wells for the safety of miners' lives been considered?

Table 1: Key Information

No	Position Job Title	Thema
1	Head of Sungai Angit Village	Green Accounting
2	Illegal oil miners	Environmental Sustainability
3	Community around illegal oil wells	Environmental Sustainability
4	Youth forum concerned with the environment	Green Accounting
5	Sub-district head	Oil and Gas Accounting Information System
6	NGO	Life safety risks
7	Head of Sungai Lilin Village	Green Accounting
8	Illegal oil miners	Environmental Sustainability
9	Community around illegal oil wells	Environmental Sustainability
10	Youth forum concerned with the environment	Green Accounting
11	Sub-district head	Oil and Gas Accounting Information System
12	NGO	Life safety risks
13	Head of PLakat Tinggi Village	Green Accounting
14	Illegal oil miners	Environmental Sustainability
15	Community around illegal oil wells	Environmental Sustainability
16	Youth forum concerned with the environment	Green Accounting
17	Head of Babat Toman Village	Green Accounting
18	Illegal oil miners	Environmental Sustainability
19	Community around illegal oil wells	Environmental Sustainability
20	Youth forum concerned with the environment	Green Accounting

When almost the same answers are obtained from at least 12 illegal miners, the data will be immediately reduced to obtain valid answers for descriptive analysis, thus providing a clear picture of the research object according to findings in the field. Data credibility testing was carried out by triangulation and member checking on primary data sources to ensure that the data presented was more reliable. This research aims to understand the phenomena experienced by research subjects, such as actions, behavior, and motivation. This includes law enforcement policies, local government regulations, the importance of a sustainable environment, green accounting synergy, and oil and gas accounting information systems are mandatory, especially in areas where illegal oil wells are practiced in order to strengthen the foundation for life safety.

The results section examines empirical data findings on the implementation of Green Accounting, Human Resources, and Sustainability Environment of Oil and Gas Accounting Information Systems based on informant interviews. Illegal oil well governance values include Green Environment, participation, human resources, risk, accountability, and sustainability.

1. Green Accounting

The relevance of green accounting for illegal oil miners usually operates without thinking about the environmental impact of illegal activities. However, green accounting can change the way mining activities are viewed. By introducing green accounting principles, miners can better understand the hidden costs associated with environmental damage and the potential benefits of more sustainable practices.

> *"The weakness of green accounting involves measuring the environmental impact of illegal oil mining activities, including 3 (three) important elements: (1). Ecosystem Damage: Illegal mining can destroy natural habitats and threaten the survival of local flora and fauna. (2). Soil and Water Pollution: Oil spills and hazardous waste from mining activities can contaminate water sources and soil. (3). Greenhouse Gas Emissions: Oil mining activities produce greenhouse gas emissions that contribute to climate change* (Informant 5)."

> *"By measuring these impacts, miners can be more aware of the environmental consequences of illegal oil mining activities as well as actions that damage the*

environment. In the context of green accounting, recording and reporting environmental costs is very important (Informant 1)."

"*Illegal oil miners need to record all costs related to mitigating environmental impacts, such as oil spill cleanup costs, restoration of damaged land, and other environmental protection efforts. This reporting can help them understand the extent to which their activities harm the environment and encourage changes in human behavior towards nature* (Informant 2)."

"*While the impact of green accounting on illegal oil mining offers short-term economic benefits, the resulting environmental damage can have significant long-term costs. Green accounting helps miners understand that more sustainable practices can produce long-term economic benefits, such as: Reduction in Recovery Costs: By reducing environmental damage, the costs required for environmental restoration are also reduced. Access to Better Markets: Sustainable mining practices can open up access to better and more diverse markets. Support from Communities: Communities negatively impacted by illegal mining are more likely to support environmentally responsible operations* (Informant 4)."

Education and awareness to increase understanding of green accounting among illegal oil miners is very important. Educational programs that highlight the importance of environmental protection and the long-term economic benefits of sustainable practices can help change behavior. Additionally, collaboration with environmental organizations and governments can strengthen these efforts. An understanding of green accounting can help illegal oil miners see the environmental impacts of their activities more clearly and consider the long-term costs and benefits of sustainable practices. By increasing awareness and adopting green accounting principles, miners can take steps towards more responsible operations and reduce negative impacts on the environment.

2. Participation

Human resources investigations into illegal oil mining involve a series of steps to understand and address illegal activities, including identification of perpetrators, work patterns, and impacts on communities and the environment. Investigative activities are carried out by collecting information about individuals or groups involved in illegal mining through intelligence, public reports, and direct observation.

"*Public reports are carried out by gathering information to create a profile of the perpetrator including background, motivation and social network, techniques used in illegal mining, equipment used and location of the activity, as well as analyzing the supply chain from exploration to distribution of illegal oil, including the role of each individual in this chain* (Informant 14)."

"*Human Resources Investigation assesses economic losses for the state and local communities, including loss of state income from taxes and royalties, is carried out by examining social impacts such as community conflicts, declining quality of life, and the potential for increased crime, assessing the damage caused by illegal mining such as land pollution and water, ecosystem damage, and health risks for local residents* (Informant 18)."

Reducing the quality of life is carried out by developing environmental recovery plans after illegal mining activities, identifying legal loopholes that allow illegal mining, and strengthening law enforcement to deal with perpetrators (Ansari et al., 2024). Developing effective policies to prevent illegal mining, including strict regulations and community empowerment programs by conducting

education and awareness campaigns in the community about the negative impacts of illegal mining (Wijayanti et al., 2024). Damage to the environmental ecosystem causes a decrease in the quality of life, providing alternative sources of income for communities dependent on illegal mining, such as job training programs and small business support, encouraging cooperation between government, law enforcement, NGOs, and communities in overcoming illegal mining. Strengthening information networks between relevant institutions to facilitate the identification and prosecution of perpetrators, HR investigations in illegal oil mining are very complex and require a multidisciplinary approach to ensure their effectiveness and sustainability (Keong, 2021: Azzolina et al., 2016: Gupta & Jangra, 2024; Zhang et al., 2023; (Okeke, 2021).

3. Human resource

Illegal oil miners are motivated by difficult economic reasons. Job opportunities are limited due to low education, and they come from disadvantaged economic backgrounds and see illegal mining as a quick way to increase income. High oil prices on the black market are the main attraction for earning a higher income compared to other jobs available to marginalized communities.

> "*Illegal oil mining has the potential to provide economic benefits with an activity that carries a very high risk of saving lives. Miners often work without adequate safety equipment, face the possibility of accidents such as explosions, fires, or exposure to dangerous chemicals and risk of being caught by authorities, which can result in criminal penalties* (Informant 6)."

> "*Illegal oil mining has a negative impact on nature and the surrounding environment. This is proven by the irregular and unsupervised mining process, which can cause ecosystem damage, soil, and water pollution, as well as loss of habitat for flora and fauna, as well as frequent oil leaks, which can worsen environmental conditions around the mining site* (Informant 9)."

> "*Illegal oil mining activities are usually supported by structured networks and organizations. This network includes individuals who provide capital, equipment, and protection from law enforcement. These organizations often work similarly to criminal syndicates, with a clear hierarchy and division of tasks. Governments and law enforcement often face major challenges in dealing with illegal oil mining* (Informant 7)."

> "*Despite efforts to crack down on these activities, including arrests and closure of illegal mining sites, the existence of powerful networks and corruption can hamper the effectiveness of law enforcement. In addition, preventive measures such as alternative economic empowerment for vulnerable communities are often necessary to reduce dependence on illegal mining* (Informant 12)."

Lack of awareness and education about the negative impacts of illegal oil mining contributes to the continuation of energy activities in the long term for the next generation. Education about the health, safety, and environmental risks associated with illegal mining can help reduce the number of individuals involved in the activity (Mohammad et al., 2024). Illegal oil mining is a complex phenomenon influenced by various economic, social, and political factors (Ramírez-Orellana et al., 2023). To address this problem effectively, a holistic approach involving strict law enforcement, economic empowerment, education, and collaboration between agencies is needed. These efforts should be directed not only at stopping illegal activities but also at resolving the root causes that drive individuals to engage in illegal oil mining (Nazir et al., 2024: H. Li & Wang, 2023: (Abdullah & Almaqtari, 2024: Chenet, 2024: Liu et al., 2021).

4. Risks

Illegal oil mining has a direct impact on environmental sustainability because mining often occurs

in forest areas, which require illegal cutting of trees to clear land, causing loss of natural habitat for flora and fauna due to illegal mining often does not follow safe operational standards, so crude oil spills can occur, polluting local soil and water sources. The use of dangerous chemicals in the extraction process can seep into the soil and water, damaging the quality of groundwater and rivers used by local communities. Mining activities can destroy the natural habitat of flora and fauna, causing loss of biodiversity.

> *"Illegal excavation of land drastically changes the landscape, causing soil erosion, landslides, and land degradation. People living around illegal mining sites are at risk of exposure to toxins from oil and chemical spills, which can cause skin diseases, respiratory problems, and other chronic diseases* (Informant 3)."

> *"Contamination of drinking water sources can cause outbreaks of infectious diseases and have a negative impact on public health. Soil and water pollution damages agricultural land and fish habitat, thereby reducing agricultural and fisheries productivity, which is the main source of income for the community* (Informant 11)."

> *"The government and society must bear large costs to restore the environment damaged by illegal mining. Illegal oil mining often has no emissions management mechanism, contributing to increased greenhouse gas emissions, which accelerate climate change. Illegal mining activities can trigger land fires that release carbon dioxide and dangerous particles into the atmosphere* (Informant 16)."

> *"Illegal mining triggers a conflict between communities and legal companies that have official permits, disrupting social stability. Illegal mining works in dangerous conditions without legal protection and social security, which can lead to labor exploitation and human rights violations. Heavy equipment and trucks used in illegal mining often damage roads and bridges built for public use, increasing infrastructure maintenance costs* (Informant 13)."

The negative impact of illegal oil mining on the environment and the sustainability of future generations requires an integrated approach that involves strict sanctions for perpetrators of illegal mining, providing alternative sustainable livelihoods to communities who depend on illegal mining (Widiastuti et al., 2024). In terms of environmental land rehabilitation and restoration of damaged ecosystems, increasing public awareness about the importance of protecting the environment and the negative impacts of illegal mining is necessary. This approach needs to be carried out collaboratively between government, non-government organizations, local communities and the private sector to achieve optimal and sustainable results (Cho & Patten, 2013; Widiastuti et al., 2024; Cho & Patten, 2013; Ansari et al., 2024; Russ et al., 1998; (Keong, 2021: Masudin et al., 2024: Leite Pacheco et al., 2022: Abbas et al., 2024; Antonini & Gomez-Conde, 2024; Wijayanti et al., 2024).

5. Accountability

This concept describes the obligation of individuals, groups, or organizations to be responsible for all actions, decisions, and policies taken by parties who have the right to receive reports or explanations. Accountability involves transparency, integrity, and honesty in carrying out the responsibilities that have been given. Green Accounting Mitigation through oil and gas accounting information system interventions involves the implementation of practices and technologies that support environmental sustainability in the oil and gas industry. Adopting ESG reporting includes information regarding environmental impacts, social responsibility, and governance of the company's oil and gas accounting information system by following sustainability reporting standards such as GRI (Global Reporting Initiative) or SASB (Sustainability Accounting Standards Board).

"Utilize accounting information systems to track and report carbon emissions from oil and gas operations by recording and managing data regarding waste produced, including volume, type, and disposal or recycling methods. Green accounting is easily accessible with technology that supports the use of renewable energy and records reductions in fossil energy consumption in the accounting system by implementing systems to monitor and improve energy efficiency in operations, as well as reporting the savings achieved (Informant 19)."

"Green accounting applies to record and managing costs associated with environmental initiatives, such as policies, investments in clean technology, or land rehabilitation programs, by recording incentives or subsidies that companies receive for green projects in the accounting system. Reducing paper use by adopting digital systems for all accounting and reporting processes through IoT (Internet of Things) technology for real-time environmental monitoring and integration of this data into accounting systems (Informant 19)."

Green accounting compliance with oil and gas accounting information system interventions, especially environmental regulations and industry standards, periodically assess the environmental impact of oil and gas operations and report findings and recommendations for improvement (Mohammad et al., 2024). Oil and gas accounting information system interventions involve training employees regarding green accounting practices and the importance of environmental sustainability in order to increase awareness about environmental impacts among employees and stakeholders through effective education and communication programs (Ram í rez-Orellana et al., 2023; (Cho & Patten, 2013).

Oil and gas accounting information system interventions communicate transparently with stakeholders regarding environmental performance and sustainability initiatives with non-governmental institutions, governments, and environmental organizations to support green initiatives and obtain feedback (Nazir et al., 2024). Oil and gas accounting information systems use blockchain technology to record transactions related to green initiatives, ensuring transparency and accountability by implementing smart contracts to facilitate automated and measurable environmental agreements (Chircop et al., 2023; *(Wassénius et al., 2024).*)

The oil and gas accounting information system intervention sets specific targets for emission reductions and monitors their achievement through accounting information systems and develops environmental performance reports that are integrated into company financial reports to inform stakeholders about the progress of sustainability (Gerged et al., 2024). Oil and gas companies can integrate green accounting into oil and gas accounting information system interventions, which not only helps in meeting regulatory requirements but also improves the company's reputation as an environmentally responsible industry player (Antonini & Gomez-Conde, 2024; (Leite Pacheco et al., 2022; (Chang et al., 2024).

6. Sustainability

Oil and gas accounting information systems can evaluate environmental risks associated with oil and gas operations by developing and implementing mitigation strategies based on the risk data obtained. Oil and gas accounting information systems use blockchain technology to record transactions related to green initiatives, ensuring transparency and accountability by implementing smart contracts for automation and enforcement of environmental agreements.

"Oil and gas accounting information systems can communicate with the environment and stakeholders transparently and responsively to increase employees' and local communities'

awareness of the importance of sustainability and environmentally friendly practices. The oil and gas accounting information system sets specific targets for emission reduction and monitors their achievement through the accounting information system (Informant 10)."

"*Oil and gas accounting information systems develop environmental performance reports that are integrated with company financial reports to inform stakeholders about sustainability progress (Ben Moussa & El Arbi, 2020). Oil and gas accounting information systems collaborate with environmental and technology consultants to obtain the latest insights and solutions for mitigating environmental impacts. Oil and gas accounting information systems benchmark with other oil and gas companies to adopt best practices and the latest innovations in environmental mitigation* (Informant 20)."

The oil and gas accounting information system provides training to employees regarding environmentally friendly practices and the importance of sustainability in order to encourage the development of employee competencies in the field of environmental management and sustainability (Ansari et al., 2024; Lu, 2024). Oil and gas companies can improve environmental management and ensure operational sustainability of oil and gas accounting information systems to manage environmental impacts more effectively and efficiently, which in turn can improve the company's overall environmental performance and sustainability (Wijayanti et al., 2024; Ben Moussa & El Arbi, 2020; Tejedo-Romero et al., 2023; *Lu, 2024).*

Efforts to strengthen the Oil and Gas Accounting Information System

Strengthening the oil and gas (oil and gas) accounting information system is very important to increase transparency, accountability, and efficiency in energy resource management. The ERP (Enterprise Resource Planning) system is integrated with a sophisticated ERP system to manage all operational aspects of oil and gas companies, including accounting, finance, logistics, and production. Big data ERP systems process large amounts of data and gain insights that can assist in decision-making, making use of accounting software to automate the recording of financial transactions, thereby reducing the risk of human error and increasing efficiency (Keong, 2021: Mota-Nieto et al., 2024: Dias et al., 2023).

Implement automated reconciliation to ensure compatibility between internal and external reports to ensure clear separation of duties between individuals responsible for various aspects of the accounting process to prevent fraud. Conduct regular internal audits to evaluate the effectiveness of internal controls and ensure compliance with policies and procedures using encryption technology to protect sensitive data from unauthorized access and regularly backup data and store it in a secure location to prevent data loss due to disasters or system failures (Leite Pacheco et al., 2022).

Compliance with international accounting standards such as IFRS (International Financial Reporting Standards) and GAAP (Generally Accepted Accounting Principles) complies with local regulations governing the oil and gas industry, including financial reporting and taxation. Provide regular training to accounting staff regarding new systems, accounting standards, and industry best practices, encouraging staff to obtain professional certification such as CPA (Certified Public Accountant) or CMA (Certified Management Accountant).

Integrate operational systems (such as production and distribution) with accounting systems to ensure consistent and real-time data by developing integrated dashboards and reports to monitor operational and financial performance simultaneously. Adopt transparent reporting practices, including disclosure of relevant financial information to the public and stakeholders (Lu, 2024). External oversight involves independent audits and reports to regulators to ensure accountability. Leveraging blockchain technology to create transparent and immutable records of transactions can increase trust and reduce the risk of fraud. Smart contracts are used to automate and enforce agreements in oil and gas transactions, thereby reducing errors and increasing efficiency (Wass é nius et al., 2024).

Collaborating with accounting and technology consultants is intended to gain the latest insights and solutions in strengthening accounting information systems. Benchmarking is carried out with other oil and gas companies to adopt best practices and the latest innovations in oil and gas accounting information systems. Oil and gas companies can strengthen accounting information systems to improve operational efficiency, ensure compliance, and support better decision-making (Okeke, 2021; M. Li et al., 2024).

Human Resource Mitigation Through Oil and Gas Accounting Information System Intervention

Human Resource Mitigation through Oil and Gas Accounting Information System intervention involves the application of technology and processes to increase efficiency, transparency, and accountability in HR management in the oil and gas sector. The Oil and Gas Accounting Information System can be used to plan, manage, and track periodic training programs for employees to record training progress and skills acquired (Dimnwobi et al., 2023; Chang et al., 2024; Sahebi et al., 2024).

The Accounting Information System identifies competency needs through analysis of performance data integrated with the accounting information system and designs appropriate development programs to improve employee skills (Stefan de Carvalho et al., 2022). Accounting Information Systems evaluate human resource performance to monitor and assess employee performance in real-time, as well as more objective and data-based performance assessments (Tiwari & Khan, 2020).

The Accounting Information System facilitates continuous feedback and rewards to employees who excel through a transparent and fair system that automates payroll processes, absenteeism recording, and other HR administration to increase efficiency and reduce human error. AIS can calculate payroll based on integrated attendance and performance data (Morelli et al., 2022; Chircop et al., 2023).

Accounting Information System to monitor and manage employee working time, overtime, and leave, thereby ensuring compliance with company policies and labor regulations (Carvalho et al., 2024). Integrate compliance modules in accounting information systems to ensure that all HR practices comply with labor regulations and industry standards. This system can provide automatic alerts about deadlines and compliance requirements (Salamai, 2023).

Human resources' role is to document and implement policies within the system, ensuring consistency and compliance throughout. Accounting information systems can maintain data security, encryption, and access control to protect employee personal information from unauthorized access (Rahman, 2002). Accounting information systems can provide limited access based on employee roles and responsibilities in the accounting information system to maintain data confidentiality and prevent misuse (Chenet, 2024).

Using accounting information systems to analyze workforce needs based on business projections and operational data. This system can help in planning workforce recruitment and development according to needs (Ben Moussa & El Arbi, 2020). Human resources can identify internal talent by analyzing performance and potential data, as well as planning career paths and professional development (Tejedo-Romero et al., 2023). The accounting information system produces human resource performance reports automatically and is integrated with financial and operational reports. This report can be used to make strategic decisions regarding HR management (Okeke, 2021).

Accounting information systems can develop dashboards that display HR performance metrics in real-time, allowing management to monitor performance and take corrective action quickly. Flexible accounting information systems allow companies to quickly adapt to changes in regulations, market conditions, or internal needs (Gupta & Jangra, 2024). This system can also support sustainability and corporate social responsibility initiatives. Human resources support employee mobility by providing data

and application access via mobile devices, thereby enabling employees to manage personal information easily (Okeke, 2021).

Oil and gas companies can improve human resource management to ensure compliance with regulations and support operational sustainability (Keong, 2021). Interventions through oil and gas accounting information systems enable companies to manage their workforce more efficiently, transparently, and accountably in order to improve the company's overall performance (Sahebi et al., 2024).

Environmental Mitigation Continuity Through the intervention of the Oil and Gas Accounting Information System

Environmental mitigation and sustainability through oil and gas accounting information system interventions involves the application of technology and processes to monitor, report, and reduce the environmental impact of oil and gas operations (Abdullah & Almaqtari, 2024). The oil and gas accounting information system adopts sustainability reporting standards such as GRI (Global Reporting Initiative) or SASB (Sustainability Accounting Standards Board) to prepare comprehensive ESG reports. The oil and gas accounting information system integrates environmental data into financial reports and provides transparent reports to stakeholders about the company's sustainability performance (Chircop et al., 2023).

Oil and gas accounting information systems can track carbon emissions from all operational activities, from extraction to distribution, and record the type, volume, and method of disposal or recycling of waste produced in oil and gas operations. The oil and gas accounting information system includes the use of renewable energy in operations and records reductions in fossil energy consumption in the accounting system (Abdullah & Almaqtari, 2024).

Oil and gas accounting information systems work using technology to improve energy efficiency and report savings achieved by monitoring sources of pollution, such as oil spills or gas emissions, and recording mitigation actions taken to reduce their impact. Oil and gas accounting information systems can document and manage environmental recovery programs for areas affected by oil and gas operations (Masudin et al., 2024).

Ensure compliance with all applicable environmental regulations by integrating compliance modules in the oil and gas accounting information system. Conduct regular environmental audits to evaluate performance and compliance with environmental standards (Wassénius et al., 2024). The oil and gas accounting information system works using IoT (Internet of Things) technology to monitor environmental parameters in real-time, such as air, water, and soil quality, by adopting a digital system to reduce paper use in all accounting and reporting processes (Tejedo-Romero et al., 2023).

CONCLUSIONS

This study evaluated four main variables: green accounting, human resources (HR), environmental sustainability, and oil and gas accounting information systems, with a focus on the integration of environmental aspects into accounting practices to support sustainability. The results of the study indicate that environmental sustainability must be integrated with the use of the latest technology to manage environmental impacts. Non-compliance with environmental regulations can reduce the image and social responsibility of local governments, especially in dealing with illegal oil wells. Green accounting plays an important role in monitoring, recording, and reporting environmental impacts such as carbon emissions, waste, and natural resource use. This supports the transparency of environmental performance reporting, which is important for building a company's commitment to sustainability and social responsibility. The results that support weak enforcement of local regulations can increase risks to public safety, environmental damage, and other negative impacts such as landslides, greenhouse gas emissions, and ecosystem damage.

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