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Environmental, Social & Governance (ESG) Implementation Strategy in Mining Companies with Design Thinking Method

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ABSTRACT

The mining industry plays an important role in economic development, but its operations often have adverse environmental and social impacts and many companies are only concerned with profit. So it is important to apply ESG (Environmental, Social, Governance) principles to companies to create a sustainable business. This thesis examines the application of ESG in PT. X is a mining company. This research is qualitative and uses descriptive analysis with the design thinking method. Observations and interviews were conducted at PT. X and using an informant from the management of PT. X. This research also aims to find effective strategies for the implementation of ESG in strengthening business sustainability in PT. X by using indicators from the ESG Reporting Guide that uses the Global Reporting Standard (GRI) in the mining sector. Based on the results of the analysis, it was found that the implementation of ESG in PT. X has achieved a percentage of 95% of the GRI Coal standard. There is one indicator that has not been implemented, namely the water and effluent indicators on the environmental aspect. Alternative strategies developed with design thinking methods are in the form of making rainwater catchment ponds, remote control waterfill, and automatic sprayers.

Introduction

Indonesia has invaluable natural resources, in the form of minerals and energy resources, just as coal. According to the Ministry of Energy and Mineral Resources, state revenues from energy resources and mineral resources reach around 20% per year (ESDM, 2014). Revenue from mineral resources and the energy sector in 2014 reached Rp 464 trillion, an increase of 61% compared to 2010 of Rp 289 trillion. Minerals and coal tend to be raised as one of the main sources of state revenue, because from year to year, the contribution of minerals and coal continues to increase significantly (Strategic Plan of the Ministry of Energy and Mineral Resources for 2020-2024, 2020). This is because the demand for coal is still high. Based on data from the Ministry of Energy and Mineral Resources in 2023, the achievement of coal production in 2023 exceeded the target, which exceeded 694.5 million tons. This condition is expected to occur until 2035.

The majority of domestic coal production is used to meet the fuel needs of coal-fired power plants, for example in 2019 67.01 million tons or around 48%. The increase

in the use of coal has an increasing trend in line with the growing consumption of electrical energy in Indonesia (Road Map for Coal Development & Utilization, Ministry of Energy and Mineral Resources, 2021).

Meanwhile, along with the increase in the use of coal for coal-fired power plants, the installed capacity of coal-fired power plants that use coal as a steam generator also continues to increase. From a total of around 65.9 thousand GWh in 2009, the installed capacity of coal-fired power plants continues to grow to 174.5 thousand GWh in 2019. The growth rate of installed capacity which reached 165% for 1 decade shows that the demand for coal for coal-fired power plants will continue to rise (Electricity Statistics of Energy and Mineral Resources, 2019).

Coal mining activities are non-renewable natural resource exploitation activities, where mining activities will have an impact on ecosystem damage. Thus, the mining industry faces various challenges, including having a significant impact on environmental and social impacts. In addition, it is increasingly difficult to obtain resources both in quantity and quality, and also have to comply with stricter environmental regulations, considering energy saving so that production costs are competitive. Industrial activities, including mining, will have an impact on the amount of resource use, liquid waste, air emissions, solid waste, and other consequences such as landscape change (Bell & Morse, 2013). Although mining activities contribute significantly to the country's economy, mining activities are considered one of the most environmentally and socially disruptive activities carried out by the business world.

In coal mining activities, the environmental impact that can occur is in the form of a decrease in soil fertility due to the stripping of topsoil and subsoil/overburden. This soil stripping will change the properties of the soil where the soil arrangement that is formed naturally with neatly arranged layers from the top layer to the bottom layer will be disturbed and exposed due to the soil stripping. In addition, coal mining activities can threaten biodiversity due to land clearing for mining, causing vegetation degradation due to land clearing activities. Other environmental impacts produced by mining activities are the highest contribution to reducing water quality. Mining clearing and clearing activities and other activities accelerate surface flows that carry pollutants into water bodies and residents' wells during heavy rains.

The impact of coal mining does not only appear when mining activities occur but also after mining operations. Most mining systems in Indonesia are open-pit mining systems (Hosseini & Wahid, 2016). Open-pit mining operations result in landscape changes. One of the conditions for landscape changes that occur is the formation of former mining pits after mining operations. In 2015 there were approximately 45 active mining pits located in an area of 4,402 ha, 183 inactive pits located in an area of 3,227 ha, and 24 pits that were being stockpiled covering an area of 273 ha (Hosseini & Wahid, 2016). The existence of abandoned former mining pits can be interpreted as the mining process as a whole having not been carried out properly and correctly and the weak supervision system. Although there have been many regulations made by the government regarding post-mining or reclamation activities, until now there are still many former mining pits

that have not been reclaimed, causing dangerous consequences for both the ecosystem and the community around the area. From 2011 to 2020, there have been 39 lives floating in former excavation holes in East Kalimantan that have not been carried out post-mining or reclamation efforts. The National Human Rights Commission of the Republic of Indonesia in the Human Rights Report on the Case of the Former Coal Mine Pit, East Kalimantan (2016:2) stated that every incident of the death of a victim in a mine pit has never been completely resolved in its legal way.

The presence of mining companies in the community will also affect the social life of people around the mining site. However, mining activities often hurt the community, including conflicts that occur between residents and companies due to land acquisition problems, water pollution, dust, and social jealousy between residents and immigrants (Nugraha et al., 2023). Furthermore, (Nugraheni & Purwanto, 2015) stated that conflicts in the community arose in the form of protests due to the disruption of roads by coal trucks, damage to roads, and traffic accidents. Conflicts in the community are also mostly triggered by the problem of waste whose existence interferes with the community's drinking water sources, the low local workforce recruited by companies, and the problem of compensation for community land.

According to Yusgiantoro (2000), coal mining activities cause pollution or air pollution and are negative externalities that have an impact on public health problems. Large-scale surface mining has the potential to contribute significantly to air pollution, especially at the operational stage. All activities during the various stages of ore extraction, processing, handling, and transportation depend on equipment, generators, processes, and materials that produce harmful air pollutants, such as particulates, heavy metals, carbon monoxide, sulfur, phur dioxide, and nitrogen oxides. Sources of mobile air pollution include heavy vehicles and cars operating on uneven roads. In line with research (Sa'adah et al., 2020), open-pit mining activities can release N2O, CO, SO2, and coal dust particles into the air, where these gases can cause ISPA. The onset of ISPA disease in the community can be caused by the inactivity of mining companies to encourage people to be more sensitive to health (MURSYIDIN et al., 2017).

Nowadays the industrial world is changing and all industries are focused on sustainability. With an emphasis on sustainability, companies focus their efforts on mitigating environmental concerns and promoting good governance while ensuring that the needs of current and future stakeholders are met (Yang & Sauve, 2016). This idea of sustainability has the goal of protecting the environment from damage and for the social needs of the community in the future. The idea of sustainability was then developed until 2001 when The European Commission issued a report entitled A European Framework for Corporate Social Responsibility (CSR). CSR is a business strategy that includes social and environmental aspects which then emerged the term ESG (Environmental, Social, Governance) where companies are recommended to include environmental, social, and governance (ESG) aspects into their structure and operations. The assumption is that organizations that implement ESG better will increase shareholder value.

Since then, the concept has evolved and investors are now demanding companies to report on Environmental, Social, and Governance (ESG) aspects as good sustainability practices. Various studies state that a company's good reputation in ESG reporting will improve a company's financial performance. In addition, the main focus of ESG is not only on the company's performance but its main goal is to reduce the environmental impact associated with the company's activities improve sustainable community welfare, and improve good governance. Galbreat (2013) states that an ESG framework is developed, and performance standards are established for companies to implement social, environmental, and governance factors to identify and monitor environmental and social risks. The effectiveness of the implementation of environmental and social management systems helps in the evaluation, control, and improvement of environmental and social performance. Thus, contributing to good governance, attracting investors, and improving the company's financial performance (Schaltegger et al., 2017).

Based on PWC's 18th Annual Report, mining companies with higher Environmental, Social, and Good Governance (ESG) ratings outperformed the market on a broader scale during the peak of the Covid-19 crisis, resulting in an average total return on shareholders of 34% over the past three years — ten percentage points higher than the general market index (PWC, 2021). The Indonesian government itself through the Ministry of Energy and Mineral Resources (Energy and Mineral Resources) has encouraged the extractive industry in Indonesia to be more transparent by the principles of environmental, social, and corporate governance (ESG) as part of Indonesia's commitment to the sustainable development mission towards the Net Zero Emissions era. Transparency is a mandate from the principles of the Indonesian Extractive Industry Transparency Initiative (EITI) and the constitution that the use of Natural Resources (SDA) needs to be accounted for by the public.

In the context of the mining industry, PT. X has committed to implementing ESG principles in its operational activities. This commitment is realized through various ESG (Environmental, Social, Governance) initiatives that have been carried out by PT. X and ESG disclosure through Sustainability Report. The Sustainability Report itself is a corporate practice covering environmental, social, and governance aspects. Ensuring that the business is prepared for future risks, challenges, and opportunities. In addition, the Sustainability Report can provide more information about the company's performance (Birtan, 2022). ESG principles themselves emerge as an important framework for inspiring sustainable innovation.

Continuous innovation is key to ensuring a responsible and sustainable future. Without innovation, we may face the uncontrollable impacts of climate change, declining biodiversity, and social disharmony (Vikrant & Kim, 2019). Although there are still many companies that face the biggest challenge in ESG implementation in Indonesia, namely regulations that are still scattered in various laws and regulations, more comprehensive regulations are still needed to ensure that companies comply with the principles contained in ESG and innovative steps in implementing these principles into company policies and operations.

This study aims to analyze the application of ESG in the policies and operations of PT. X and designing a strategy for implementing ESG in the company. Theoretically, this research is expected to contribute to the field of management science, especially related to ESG management. The expected practical benefits are to provide additional insight into the implementation and strategy of ESG implementation in mining companies so that the results of this study can be used as a reference in the development of similar policies.

Method

This study uses a quantitative approach with a mixed method, where the quantitative method is used to calculate the percentage of ESG implementation based on GRI standards, while the qualitative method strengthens quantitative data through analysis of environmental, social, and governance categories. This mixed approach was chosen to provide a more comprehensive understanding of the research problem by reconciling quantitative data in the form of numbers and qualitative data in the form of descriptive details. This study relies on primary data from observations and interviews as well as secondary data from the sustainability report of PT. X year 2023. The GRI standard is used to measure the suitability of sustainability reporting on economic, social, and environmental dimensions, considering that GRI indicators have high validity (Bhatia & Tuli, 2018). The research stages consist of the initial, implementation, and final stages, including the preparation of research permits, the implementation of interviews and data processing, to the presentation of research results. The research was carried out for eight months, from February to September 2024, with a schedule of activities including literature studies, data collection, data analysis, and the preparation of final project reports.

Results and Discussion

This fourth chapter explains the results of the research that has been carried out. The method used in this study is mixed (mixed method). The quantitative method is used to calculate the percentage of ESG implementation based on GRI standards, while the qualitative method is used to strengthen the quantitative data in the category analysis environmental, social, and government that has been calculated using Microsoft Excel and conclusions were drawn. Conclusions in the form of implementation results and issues in the implementation of ESG in each category environmental, social, and government will be re-analyzed to formulate a strategy based on the design thinking.

Calculation of ESG Implementation at PT. X

This study measures the percentage of ESG implementation based on GRI standards. In this study, an assessment was carried out on the sustainability report of PT. X and interviews with informants with results as shown in Table 4.1. Interviews are conducted via WhatsApp or Zoom applications. Interviews were conducted with 5 informants from different departments with work experience of more than 5 years with the status of permanent employees.

The percentage of ESG implementation is obtained by dividing the number of indicators applied to each aspect by the overall number of indicators in each aspect. When calculated as a whole, the implementation of ESG in all aspects at PT. X is 95%. This ESG score typically ranges from 0 to 100, with a score of less than 50 considered relatively poor and a score of more than 70 considered good. So, based on this percentage, the implementation of ESG at PT. X belongs to the good category. The following is Table 1 of the implementation of ESG at PT. X.

Table 1
The implementation of ESG at PT. X

It	Indicator	*Checklist*
Environmental Aspect		
1	GHG Emissions	✓
2	Climate adaptation, resilience, and transition	✓
3	Closure and rehabilitation	✓
4	Air emissions	✓
5	Biodiversity	✓
6	Waste	✓
7	Water and effluent	-
Social Aspect		
1	Economic impact	✓
2	Local communities	✓
3	Land and resource rights	✓
4	Indigenous rights	✓
5	Conflict and security	✓
6	Asset reliability and crisis management	✓
7	Occupational health and safety	✓
8	Employment practices	✓
9	Child labor	✓
10	Modern forced labor and slavery	✓
11	Freedom of association and collective bargaining	✓
12	Non-discrimination and equal opportunity	✓
Governance Aspect		
1	Anti-corruption	✓
2	Payments to the government	✓
3	Public policy	✓

Descriptive Analysis of ESG Implementation at PT. X

Based on the results of the interview, of the seven indicators in the environmental aspect, six indicators have been implemented. Meanwhile, one other indicator has not been implemented. These indicators are water and effluent. On the water and effluent indicators, the company has revealed and tested the effluent water quality but the company has not implemented water management.

Social Aspect

Based on the results of ESG assessments with GRI indicators and the results of interviews with informants, companies have generally implemented ESG practices. Of the 12 indicators on the social aspect, all indicators have been implemented. Below is a description of the implementation of ESD indicators on social aspects at PT. X.

Governance Aspect

Indicators on *the governance aspect* in ESG consists of 3 indicators. Based on the analysis of company documents and the results of interviews with informants, the company has implemented all ESG practices in the *governance aspect.*

Determining ESG Implementation Strategies

After an analysis of the implementation of ESG at PT. X there is one indicator that has not been implemented. The indicators that have not been implemented are water and effluent indicators on the environmental aspect. In this indicator, the company has conducted tests on the quality of effluent water flow, but water management at PT. X is still not implemented properly, causing various problems including the unavailability of adequate water, the river water source is getting thinner which has been a source of water for mining activities, resulting in disruption to mining operational activities. Limitations of Support Areas such as messes, and transportation require strategy so that it does not interfere with the production process at PIT. One of the infrastructures that has a great influence on production activities is the availability of water. In addition, in mining activities, the mobility of material and coal transportation units is very high to achieve production targets. This causes the condition of the mine road to be very dusty. Dusty mine roads are very dangerous for the safety of workers because of the limited visibility that can cause incidents, besides that it can also interfere with the health of workers due to inhalation of dust. Therefore, based on the Decree of the Minister of Energy and Mineral Resources of the Republic of Indonesia Number 1827K/30/MEM/2018 concerning Guidelines for Good Mining Engineering Principles, environmental management is needed to minimize dust concentration. One of the commonly used ways to overcome dust problems is to water the road regularly. Regular watering cannot be done if the available water is insufficient. In the priority scale of water use which refers to Law No. 17 of 2019, the basic needs of the community are the most priority followed by agricultural needs, followed by efforts in the use of groundwater/rivers. Thus, PT. X as a business entity must prioritize the basic needs of the community in the use of water sources, namely river water.

Based on the Sustainability Development Goals (SDGs 2023) document, the parent company of PT. X, the company launched a program related to reducing the intensity of water use which has a target of reducing 23.66% from the 2019 baseline, this is also a derivative of the Sustainability Aspiration to its subsidiary, namely PT. X. Although the operational area of PT. X is included in the low-risk water stress area (based on the Aqueduct Water Risk Atlas), PT. X realizes the importance of water resources for the sustainability of the surrounding community, the environment, and future generations. For this reason, PT. X takes the initiative in the future to participate in reducing water

consumption by reducing water use intensity by up to 15% which is targeted to be achieved by 2030. The development of strategies for the implementation of ESG indicators that have not yet been implemented will be carried out by the following design thinking method.

Empathy

In the first stage, the researcher identifies the problems, challenges, and needs of the target users. There are 3 ways to understand user needs, namely observing user activities and interactions (observe), helping to express the user's perspective through stories and things they do (engage), and being directly involved in the activities carried out by users (immerse) (Durlista & Wahyudi, 2023).

In this study, the researcher carried out the empathize stage by observing and engaging through interviews and observing activities carried out by users. The target persona is the Head of the Mining Support Department. At this stage, Persona was chosen because of his position as the head of the mining support department who has more than 10 years of experience at PT. X, so that it is a representative of all employees in the mine support area. At this stage, the researcher made an empathy map. An empathy map is a visualization tool used to articulate what the user team knows and to build a broader understanding of the "why" aspects behind the user's needs and wants. The researcher used the four quadrants in the empathy map as the main basis to ask questions and find out the needs of users.

Define

The defined process is a process of identifying core problems that will help to solve user problems based on the empathize stage (Azizah et al., 2024). After the empathize stage, it has been identified that the problem area or core problem at this stage is the absence of effective water management. This issue is considered a priority because based on the sustainability report of PT. X, the company has not disclosed water management and water-related impacts. In addition, based on information from the results of an interview with the Head of the Mine Support Department, it is known that the company is still in the stage of developing an innovation program related to water problems in the mining area. The absence of water management also has an impact on the company's operational activities and the surrounding community which is also affected due to the absence of effective water management from the company. Based on a study by Välisalo et al. in 2014, water management is currently the most challenging stress factor in the mining world. Mining affects the quality and quantity of water in the mining area and its surroundings and changes hydrological and topographic conditions, sometimes drastically.

At this stage, a user journey map is created. The stages of the user journey map are diagrams that map the steps that users go through during activities. This journey map reflects how user activity is from upstream to downstream.

Ideate

Ideate (idea/innovation) the third stage of design thinking is the process of producing creative ideas in the design of a design and can solve the topic of the problem in the first stage of the process "Empathize" so that this stage produces opinions, suggestions, ideas, inputs to be implemented in the design design. In this study, the author has collected ideas from the results of brainstorming with informants. Some of the ideas that were successfully collected were then selected and selected several priority ideas. Idea creation aims to be used in design later.

Prototype

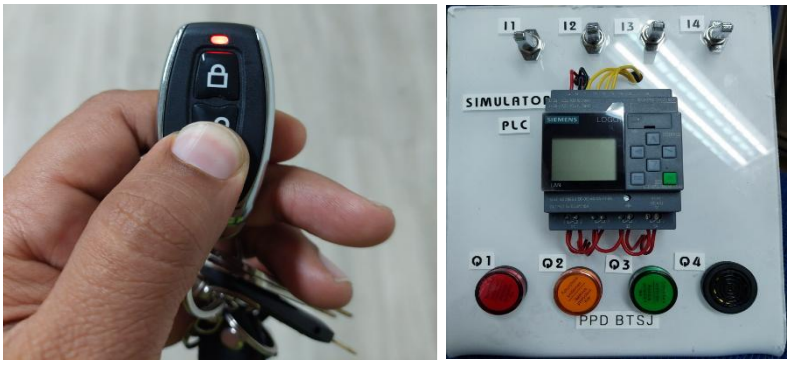
At the prototype stage, a product is developed in a scaled-down version or as a simulated version or sample, usually, prototypes are made in the form of sketches, paper mockups, digital mockups, and so on. In this study, after the process of collecting data, ideas, and solutions is completed, the next step is to create several simulations.

Prototype-1 (Water Reservoir)

Figure 1
Prototype-1

The creation of a pond for rainwater storage for waterfill reserves so that it does not take from river water and monitoring the topographic condition of the mine using LIDAR (Light Detection and Ranging) to find out the areas that have the potential to become rainwater. The pond is formed from a natural basin by damming and making embankments. The pond water will be used to collect rainwater and be used to water the mine area. The pond is installed with a waterfill and a pump that is tested by a pH Meter 1 time a week.

Prototype-2 (Remote Control Waterfall)



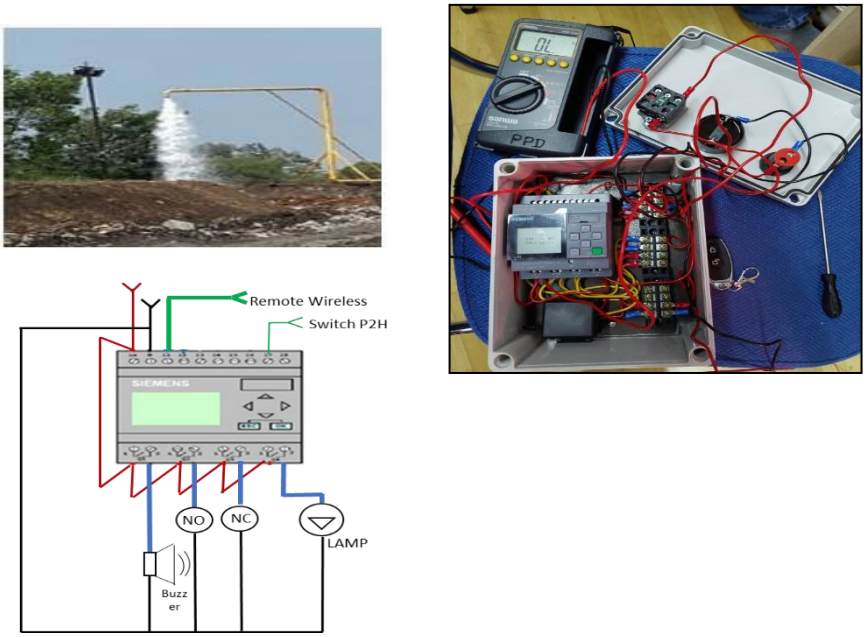


Figure 2
Prototype-2

The remote control of the waterfill is made so that the pump is automatically on-off, so the operator does not need to get off the unit to ensure the water is full. This improvement is carried out to prevent over fuel consumption in the pump unit, prevent damage to the water fill pad, and prevent water from being wasted due to the 24-hour operation of the pump.

Prototype-3 (Automatic Sprayer)

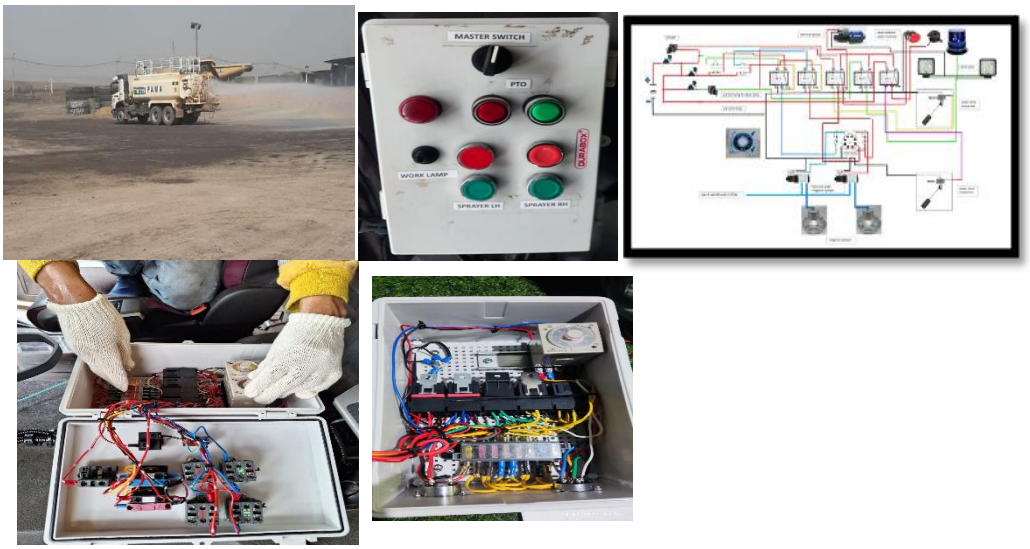


Figure 3
Prototype-3

This improvement was made to intermittently follow the standard watering process so that the watering process does not waste water. The watering that was initially 20000L could only be used to water roads with a distance of 2.5 KM after innovations were made in the 20000L sprayer water can be used to water roads with a distance of 7 KM.

Testing

The final stage of this research is testing or testing, which is the stage after all the designs are made and then experiments are carried out to validate the solution of the design that has been made. The testing process is a test on a prototype that has been made by conducting experiments on users.

The testing stage in this study involved 9 respondents who were 3 water truck operators, 3 pump crews, 2 supervisors, and 1 head of the mine support section. The testing results are measured based on the stages of each prototype and performance measurement which is measured by assessing the Net Promoter Score (NPS), Customer Effort Index (CEI), and Customer Satisfaction Index (CSI). This performance measurement was obtained from the results of interviews related to several questions asked to respondents. Testing is carried out with several stages of testing, namely as follows:

Prototype-1 (Water Reservoir)

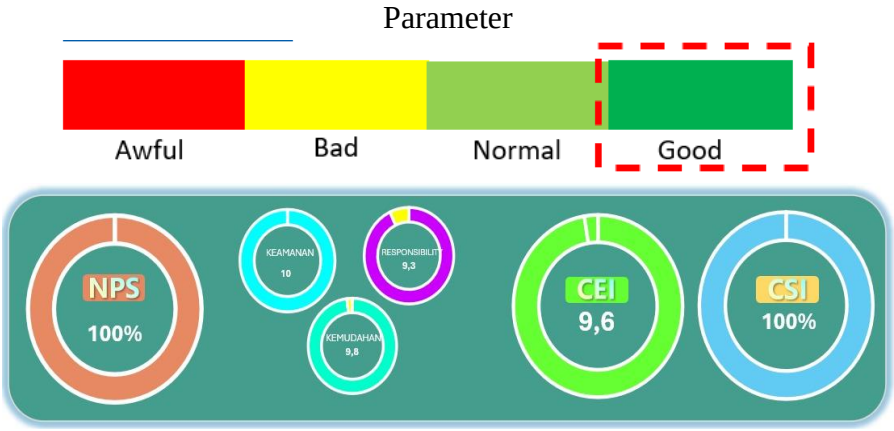
In prototype 1, the testing *stage* is carried out in the following stages:

1. The pH measurement of pool water is done once a week with normal water pH standards.
2. The volume of water must be sufficient from 3 Watertrucks and last up to the next 10 days.
3. Safety aspect*:* there are embankments, barricades, signboards, pump volume, and discharge information, and equipped with buoys.

Based on the results of the test, it can be concluded that the performance measurement for prototype-1 can be used properly and is easy to use by users.

Table 2
Testing Results of Prototype-1 Water Reservoir

Name of Respondent	Pengukuran PH	Volume Air	Safety	Success Ratio
	Step 1	Step 2	Step 3	
A	●	●	●	● 3/3
B	●	●	●	● 3/3
C	●	●	●	● 3/3
D	●	●	●	● 3/3
E	●	●	●	● 3/3
F	●	●	●	● 3/3
G	●	●	●	● 3/3
H	●	●	●	● 3/3
I	●	●	●	● 3/3



Gambar 4
Performance Measurement Prototype-1

Prototype-2 (Remote Control Waterfall)

In prototype 2, the following testing steps are carried out:

Step 1: testing the connectivity between the remote and the on-off switch at the pump

Step 2: The real-time remote button is the same as the button on the switch on off the pump

Step 3: battery life

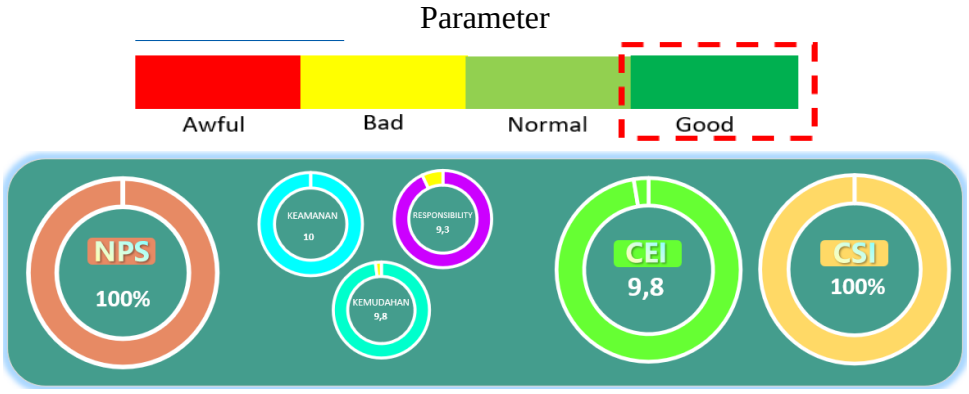
Step 4: remote and pump signal distance

Step 5: the remote can work after the P2H of the pump / daily check before the pump runs

Based on the results of testing It can be concluded that users can use the prototype well and without difficulty and according to users, the prototype has good parameters in each stage. Result Testing Prototype-2 can be seen in the following table 3.

Table 3
Hasil Testing Prototype-2 (Remote Control Waterfall)

Name of Respondent	Operation		Durability		Safety	Success Ratio
	Step 1	Step 2	Step 3	Step 4	Step 5	
A	●	●	●	●	●	5/5
B	●	●	●	●	●	5/5
C	●	●	●	●	●	5/5
D	●	●	●	●	●	5/5
E	●	●	●	●	●	5/5
F	●	●	●	●	●	5/5
G	●	●	●	●	●	5/5
H	●	●	●	●	●	5/5
I	●	●	●	●	●	5/5



Gambar 5
Performance Measurement Prototype-2

Prototype-3 (Automatic Sprayer)

In prototype-3 stages testing is carried out in the following stages:

Step 1: testing the connectivity between the automatic watering sensor and the actual watering unit

Step 2: Intermittent watering with a 5-second interval of watering duration at a speed of 20 Km/h

Step 3: The automatic unit sensor resistance of each unit is operated

Step 4: Speed of activating the sensor with actual watering

Step 5: Watering can be done intermittently and set on each street with a watering duration with a 3-second interval for speed.

Based on the results of testing on prototype-3, it is known that the tool can function properly and users have ease in using the tool.

Standardization of Innovation Program Implementation

For the implementation of innovation programs in water management at PT. X can run continuously and can encourage continuous improvement, so the author feels the need to standardize the implementation of the program. The standardization of water management is found in the following table.

Table 4
Standardization of the Implementation of Water Management Innovation in PT. X

NO	Standarisasi	Activity	Method Control	Checked by
1	The lowest point for the main reservoir has not yet been formed	Utilizing earthen basins for rainwater catchment as a water source	The pit service team checks the water level < 1 m so that the pump strainer does not hang which causes cavitation and does not pump	Plant Department and Pitservice Department
2	The pump operates at the time of filling TW.	The use of fuel in the water pump so as not to be wasteful and prevent the waterfall pad from being damaged and bumped with the pump on off controller automatically	Each tw must have a remote waterfall and be checked by the supervisor at the beginning of each shift during the availability of remote waterfall at p5m	Plant Department and Pitservice Department
3	Need to procure an automatic sprayer module.	Make an automatic sprayer system module that is automatically controlled so that water use is maximized and by intermittent watering standards.	Calibrate and test the function of each service	Plant Department

Conclusion

Based on the process of collecting and analyzing research data, it was concluded that PT. X has implemented ESG practices in the company's policies and operations with an achievement rate of 95% of the 2022 GRI coal standard so that the implementation of ESG at PT. X is categorized as good. However, there are ESG indicators that have not been implemented, namely in the water and effluent aspects in the environmental dimension. Although the company has conducted water quality testing on effluents, effective water management has not been implemented. The analysis of ESG implementation strategies on water indicators using the design thinking method revealed various problems, such as dusty work areas and mining roads that reduce visibility, ineffective watering of mining roads, inadequate water sources, and complaints from

residents around mining areas. To overcome this, program innovations are designed in the form of creating rainwater reservoirs as waterfill reserves so as not to use river water, as well as making remote control waterfill and automatic spray. The design thinking method has proven to be very helpful in developing prototypes that suit the needs and experience of the user. As a suggestion, companies are advised to conduct a re-analysis of the effectiveness of the strategy after one year of implementation, as well as follow-up research on the social and environmental impacts of program innovations implemented in mining companies.

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