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The Correlation Between the Presence of MSMEs and the Minimum Wage in the Special Region of Yogyakarta in 2019

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ABSTRACT

Micro, Small, and Medium Enterprises (MSMEs) are businesses based on creative industries. With a foundation in creativity, MSMEs can adapt to the current needs of society. MSMEs contribute significantly to the Indonesian economy by absorbing approximately 50% of the workforce. MSMEs have been growing rapidly across Indonesia, particularly in the Special Region of Yogyakarta. In 2019, there were 248,499 MSMEs recorded in this region. The large number of MSMEs in Yogyakarta provides significant employment opportunities and workforce absorption. However, despite the high number of MSMEs, a persistent issue for workers in the region is relatively low wages compared to other areas. The Regional Minimum Wage (UMR) in the Special Region of Yogyakarta was Rp 1,570,923 per month in 2019, making it the lowest in Indonesia. This poses a dilemma for the Yogyakarta regional government. Raising the minimum wage could potentially harm creative industries such as MSMEs, which might struggle with increased operational costs, including labor expenses. The authors seek to explore the correlation between the existence of MSMEs in Yogyakarta and the regional government's policy in determining the minimum wage, considering several aspects: 1) The number of MSMEs in Yogyakarta; 2) The number of workers absorbed by MSMEs; 3) The minimum wage in Yogyakarta; 4) The comparison between MSME revenues and labor costs. On average, MSMEs employ 1-2 workers, with monthly revenues averaging around Rp 4.3 million. This revenue is typically reinvested into operational expenses. If an MSME employs 1-2 workers, it needs to allocate Rp 1.5–3 million per month to pay wages. If the government raises the minimum wage, MSME operational costs would increase, potentially threatening the sustainability of these enterprises.

1. Introduction

Micro, Small, and Medium Enterprises (MSMEs), or UMKM, are businesses based on creative industries. MSMEs operate flexibly and are reactive to customer needs [1], making it necessary for them to adjust and stay updated with market demand. Furthermore, 86.33% of MSMEs in Indonesia

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are self-funded [2], meaning that the revenues or profits generated by MSMEs are reinvested as capital to sustain their operations. As enterprises catering to middle-to-lower economic segments, MSMEs also assist the government in absorbing the workforce. In developing countries, MSMEs contribute to employing around 50% of the workforce. In Indonesia, MSMEs account for 99.9% of all businesses [3], making their contribution significant in reducing unemployment by creating jobs. The benefits of MSMEs in job absorption are also evident in the Special Region of Yogyakarta (DIY). In 2019, MSMEs in DIY employed more than 480,000 workers. However, absorbing labor also means MSMEs must pay wages to the workers they employ. When paying wages, MSMEs must comply with government policies regarding the Minimum Wage, which is the legally mandated wage paid to employees [4]. Policy, in this context, refers to strategies and synergies implemented by the government to provide better services and impacts for society [5]. The Minimum Wage policy is designed to serve as a guideline for achieving shared objectives, given its foundational role [6]. Therefore, the Minimum Wage policy must balance the interests of both business owners and workers.

However, the wages paid by MSMEs to their employees rely heavily on the revenues they generate. With over 80% of MSMEs being self-reliant [2] and having annual revenues ranging between Rp 50 million and Rp 50 billion as defined by Law No. 20 of 2008, MSMEs need careful financial planning to align employee wages with the Minimum Wage policy. Mismanagement of wage planning can lead to an imbalance between monthly employee salaries and monthly revenues, which could result in financial losses for MSMEs due to their wage obligations.

The government, as the creator of public policies, plays a crucial role in determining the Minimum Wage policy. The wages businesses are required to pay their workers are regulated by government policies, particularly by local governments based on regional conditions. Since setting the Minimum Wage falls under the domain of public policy-making, the government must consider various aspects when formulating these policies [7]. Similar opinions emphasize that public policy-making, particularly regarding the Minimum Wage, must also take environmental, social, and economic aspects into account [8].

The Minimum Wage policy depends on the level of workforce absorption in the labor market [9]. Additionally, as workforce absorption increases, the Minimum Wage tends to decrease [10]. Both statements relate to MSMEs' operational needs, including their monthly revenues and labor costs. As independent businesses, MSMEs must adapt to market demands to maximize their monthly revenues, which are then used to cover operational costs, including employee wages. If employee wages are not excessively high, MSMEs can manage their operational costs more efficiently. Conversely, high wage costs can disrupt MSME operations and even lead to bankruptcy. Another opinion suggests that business owners consider wages as part of operational expenses that must align with the Minimum Wage policy. High wage costs may force businesses to reduce their workforce [11]. Considering these factors, the government is required to establish a Minimum Wage policy that accommodates both MSMEs and workers to provide solutions for both parties.

The Special Region of Yogyakarta (DIY), which had more than 248,000 MSMEs in 2019, faces another issue related to the Minimum Wage. In 2019, DIY had the lowest provincial minimum wage in Indonesia, amounting to approximately Rp 1.5 million. This raises the question of how DIY, as a province with over 240,000 MSMEs in 2019, simultaneously became the province with the lowest minimum wage in the country.

2. Method

This research employs a case study method with a qualitative approach. The object of the study is the Minimum Wage in the Special Region of Yogyakarta (DIY), focusing on the year 2019. The data used in this study consists of secondary data sourced from the Central Statistics Agency (BPS) and relevant articles. The findings are presented descriptively.

3. Results and Discussion

3.1. Number of MSMEs in the Special Region of Yogyakarta

Based on Sectoral Statistics Data regarding the MSME Profile in DIY published by Bappeda DIY, there were 248,499 MSMEs in DIY in 2019 [12]. The number of MSMEs in DIY is relatively high, especially when considering the geographical size of the region. Compared to East Java and West Java provinces, DIY covers less than 10% of the area of either province. However, while East Java and West Java were the provinces with the highest number of MSMEs in 2019, each with more than 500,000 MSMEs, the difference in MSME density compared to DIY is not significant.

3.2. Number of Workers Employed by MSMEs

The number of workers employed by MSMEs in DIY in 2019, based on Sectoral Statistics Data regarding the MSME Profile in DIY, reached 484,630 workers. If the total number of workers is averaged with the total number of MSMEs in DIY, each MSME employs approximately 1–2 workers. Based on this data, it is estimated that MSMEs face operational cost burdens in the form of wages for 1–2 employees each month.

3.3. Minimum Wage in the Special Region of Yogyakarta

Based on data published by the Central Statistics Agency (BPS) of DIY, the minimum wage (UMR) in DIY in 2019 was IDR 1,570,923 per month [13]. Within the region, there are four regencies and one city with variations in the Regency/City Minimum Wage (UMK) for 2019: 1) Yogyakarta City: IDR 1,848,400; 2) Sleman Regency: IDR 1,701,000; 3) Kulon Progo Regency: IDR 1,613,200; 4) Bantul Regency: IDR 1,649,800; 5) Gunungkidul Regency: IDR 1,571,000. From the data, it is evident that the UMK in DIY does not exceed IDR 2 million per month, with the highest being Yogyakarta City at IDR 1.8 million. In comparison, the UMR in East Java was approximately IDR 1.7 million, but some regencies/cities had UMKs exceeding IDR 3 million per month, such as Sidoarjo Regency and Gresik Regency [14]. West Java showed a similar trend, with a UMR of approximately IDR 1.6 million, but some regencies/cities, such as Karawang Regency and Bekasi City, had UMKs exceeding IDR 4 million per month [15]. This discrepancy is reasonable since, according to data from the Ministry of Industry, regions like Sidoarjo, Gresik, Karawang, and Bekasi are industrial zones, which generate larger revenues compared to MSMEs [16].

3.4. Comparison of MSME Revenues with Labor Costs

According to the Sectoral Statistics Data on the MSME Profile in DIY published by Bappeda DIY, the average monthly revenue of a single MSME in DIY in 2019 was IDR 51.8 million per year, equivalent to approximately IDR 4.3 million per month. MSMEs rely on their revenue to maintain smooth business operations, avoiding disruptions or bankruptcy. Given the regular expenses for operational costs, assets, labor costs, and other routine expenses, MSMEs must carefully prioritize how to allocate their revenue. With an average monthly revenue of IDR 4.3 million, an MSME employing 1–2 workers at the DIY minimum wage of IDR 1,570,923 per worker per month would

spend IDR 1.5–3 million on wages alone. This leaves MSMEs with approximately IDR 1.3–2.8 million per month to run their business.

3.5. Government Policy on Minimum Wage in DIY

Comparing the minimum wage policies of DIY, East Java, and West Java, DIY has the lowest UMR and UMK, while the UMRs in East Java and West Java are only slightly higher than that of DIY. However, both provinces have several regencies/cities with UMKs exceeding IDR 3 million. This can be attributed to the presence of industrial zones in certain regions of East and West Java, such as Sidoarjo and Karawang Regencies, where industrial revenues exceed those of MSMEs. Fischer's statement supports this, noting that public policy—such as minimum wage policies—needs to consider environmental, social, and economic factors [8]. The economic potential of a region through industries with revenues surpassing MSMEs is a significant consideration for determining minimum wage policies. In the case of DIY, the region has a relatively small number of industries generating revenues higher than MSMEs. This is primarily due to the limited availability of land to attract investors and establish industrial zones in DIY [17]. This limitation is compounded by the fact that DIY's total area is less than 10% of East Java and West Java. The absence of industrial zones in DIY's regencies and cities prevents the government from setting higher UMR or UMK levels.

If the government were to increase the UMR to IDR 2 million per month or set UMKs above IDR 2 million in certain areas, MSMEs would face significant financial burdens. With MSMEs already paying IDR 1.5–3 million per month in wages from an average monthly revenue of IDR 4.3 million, any increase in the UMR or UMK would further strain their operational budgets, potentially leading to bankruptcy. Additionally, there is a risk that MSMEs may relocate from certain regencies/cities in DIY to other areas or even outside the province if UMK levels exceed IDR 2 million per month. Such relocations would impact local government tax revenues, as MSMEs contribute to taxes on specific goods and services related to their operations. Thus, the DIY government's decision-making regarding the minimum wage policy in DIY is influenced by the presence of MSMEs and industrial zones in the region.

4. Conclusions

The determination of the minimum wage in DIY in 2019 was also influenced by the presence of MSMEs and the availability of industrial zones in the region. If the DIY government were to raise the minimum wage (UMR) to at least IDR 2 million per month, it would significantly impact MSMEs. With over 240,000 MSMEs generating an average monthly revenue of around IDR 4.3 million, there would be a potential risk of bankruptcy for many MSMEs in DIY. Furthermore, an increase in the minimum wage (UMK) in certain districts/cities within DIY could lead to the relocation of MSMEs to other districts/cities within DIY or even outside DIY, where the minimum wage is lower.

The availability of industrial zones also influences minimum wage policies. With industrial zones in place, the DIY government could raise the UMK in districts/cities with such zones without worrying about losing revenue from taxes on goods and services. In this context, MSMEs could contribute to increasing the minimum wage in DIY by merging with one another. This would enable MSMEs in DIY to level up to the industrial scale, adopting business models that do not require large industrial areas but generate high revenues, thereby covering employee salary expenses.

Conflict of interest

The authors declare no conflict of interest.

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The Effect of 60-Minute Walking Exercise and Stretching on Heart and Lung Strengthening

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ABSTRACT

Heart disease and respiratory disorders are major health issues in modern society, with sedentary behavior increasing the risk of heart disease, reducing lung capacity, and causing cardiovascular diseases and obesity. Many workers face limited time for exercise, prompting this study to evaluate and compare the effects of a 60-minute walking exercise and stretching on heart and lung strengthening in Yogyakarta. Using an experimental design, the study targeted workers aged 20-40 years who were healthy, office-based with sedentary behavior, had normal body weight, and were willing to participate in all provided exercises. Data were collected using questionnaires and the Cooper test to measure cardiorespiratory endurance over 12 minutes, and a t-test was conducted to compare pre-test and post-test scores. Results from 30 participants showed that the t-value of 5.448 exceeded the t-table value (df 14) of 1.76131, with a significance level of 0.000 < 0.05. This indicates that both the 60-minute walking exercise and stretching were proven effective in improving heart and lung strength.

1. Introduction

Heart disease and respiratory disorders are two major health issues faced by modern society. A sedentary lifestyle, where individuals spend extended periods sitting, increases the risk of heart disease and reduces lung capacity. Therefore, efforts to improve cardiorespiratory health through various physical exercise methods are critical. Sedentary behavior, defined as a lifestyle characterized by prolonged inactivity, contributes to low physical activity levels. This can lead to various health problems such as overweight, obesity, diabetes mellitus, hypertension, and cardiovascular diseases (González et al., 2017). Furthermore, Lavie et al. (2019) emphasized that a

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persistently sedentary lifestyle can trigger numerous diseases, including cardiovascular issues and obesity.

Sedentary behavior has been identified as a key factor associated with cardiovascular and metabolic morbidity and mortality (Rosenkranz et al., 2020). In the workplace, many workers spend more than 70% of their time sitting. However, the time spent working does not always directly correlate with productivity. Companies are thus encouraged to implement policies that focus on worker health, such as reducing sedentary time and promoting physical activity (Rosenkranz et al., 2020). Among students and young professionals, the tendency to sit for long periods can disrupt metabolism, increase the risk of obesity, and cause problems such as back pain and mental health issues (Motuma et al., 2021). Engaging in 150 minutes of moderate-intensity physical activity per week, combined with high-intensity activities, can reduce the risk of diseases caused by sedentary behavior. Therefore, individuals with a sedentary lifestyle need clear guidelines on the types of physical activities they should engage in (Gilchrist et al., 2020).

Physical activity not only improves heart performance but also contributes to slowing the aging process. By recognizing these benefits, individuals are expected to feel more motivated to break away from a sedentary lifestyle. Previous research by Zein (2020) demonstrated that aerobic exercises, light resistance training, and stretching positively impact heart and lung strength. However, there is still a lack of understanding regarding the comparative effectiveness of 60-minute walking exercises versus stretching in strengthening the heart and lungs. This study aims to evaluate the health impact of exercise, considering that many people have limited time to engage in physical activity. Specifically, this research will examine the effects of 60-minute walking exercises, stretching, and 12-minute runs on heart and lung strength. Despite existing research, there remains insufficient information about the specific impact of 60-minute walking exercises on heart and lung strengthening. By enhancing understanding of how various exercises affect vital organs, it is hoped that individuals will feel more encouraged to adopt an active lifestyle. This study aims to contribute positively to the prevention of heart disease and respiratory disorders within society. Additionally, the findings are expected to provide deeper insights into the most effective types of exercises for improving cardiorespiratory health and assist in designing physical training programs for individuals at high risk of these diseases.

2. Method

This study used a quasi-experimental method. The population consisted of workers in Yogyakarta. The sampling technique employed was purposive sampling, with the following criteria: 1) workers aged 20-40 years, 2) in good health and not currently ill or undergoing medical treatment, 3) sedentary office workers, 4) normal weight category, and 5) willing to participate in all the exercises provided. The instruments included a questionnaire and the Cooper test to measure cardiorespiratory endurance over a 12-minute duration. Data analysis was conducted using a t-test to compare the differences between pretest and post-test scores. Statistical significance was set at $p<0.05$.

3. Results and Discussion

The effect of a 60-minute walking exercise combined with stretching is presented through the descriptive analysis of pretest and posttest results as follows:

Table 1. The effect of 60 minute walking with stretching

No	*Pretest Result*	Score	*Posttest Result*	Score	Gain
1	2460	54	2715	65	200
2	2445	53	2700	64	215
3	2490	55	2750	67	210
4	2495	55	2760	67	195
5	2500	55	2745	67	205
6	2460	54	2695	64	220
7	2510	56	2770	64	195
8	2540	48	2800	69	210
9	2610	61	2540	57	195
10	2545	57	2802	69	200
11	2410	51	2670	63	200
12	2550	58	2870	72	205
13	2310	46	2620	61	195
14	2580	59	2505	55	220
15	2587	50	2520	56	215
Average	2499,466667	54,1333333	2697,46667	64	205,333333
Min	2310	46	2505	55	195
Max	2610	61	2870	72	220

Based on Table 1, the average 60-minute walking exercise combined with stretching showed an increase of 205.33 meters.

Table 2. *Paired sample t Test*

Uji *Paired T* tes				
Data	**Mean**	**t value**	**sig**	**ttable(14)**
Pretest 60 menit walking + *Stretching*	2499.466667	-5.448	0.000	1.76131
Posttest 60 menit walking + *Stretching*	2697.46667			

Based on Table 2, the t-value for the pretest-posttest of the 60-minute walking exercise combined with stretching is -5.448. The negative t-value indicates that the average value of the test

group is lower. However, when making decisions in the paired sample t-test using the t-table, the value can be considered positive.

The results of the study showed that the 60-minute walking exercise combined with stretching produced positive outcomes for the participants throughout the activity and treatments provided. Based on these findings, the strengthening of the heart and lungs in each individual demonstrated significant improvement, as seen from the increased results before and after treatment. This improvement is evident from the increase in minimum and maximum values for both exercises. For example, the minimum score for the 60-minute walking exercise with stretching increased from 46 to 55, with an average score of 54.13, while the maximum score increased from 61 to 72, with an average of 64. The success of the exercises can be attributed to the proper execution of the training program, which adhered to the prescribed guidelines and methods, leading to optimal outcomes aligned with the study's goals and objectives.

Physical activity programs are recommended to include at least 30 minutes of moderate-intensity exercise (burning 4-7 kcal/min) performed 4-6 times per week (with a minimum daily expenditure of 200 kcal) and at least twice a week (Iskandar & Indaryani, 2020). Proper, consistent, and regular physical exercise induces changes in the body's systems, including metabolism, the nervous and muscular systems, and the hormonal system. Effective training should follow a structured sequence or phases, including a warm-up, the main exercise, and a cool-down (Irianto, 2006; Suharjana, 2018).

The warm-up phase prepares the body for exercise and helps prevent injuries. A good warm-up should elevate body temperature to 38°C or achieve a heart rate of 50-60% of the Maximum Heart Rate (MHR) and typically lasts 5-10 minutes (Suharjana, 2018). The main exercise phase consists of a series of movements tailored to the specific training objectives, usually lasting 20-60 minutes (Irianto, 2006). The cool-down phase, which is often overlooked, is essential to restore physical and mental states post-exercise. Cool-down sessions generally last 2-10 minutes, depending on individual needs (Suharjana, 2013).

Successful training is achieved by meeting key quality standards, including training objectives, the use of appropriate facilities and equipment, selecting the right training models, and most importantly, adhering to the correct training dosage. The success of any training program also hinges on adhering to the FITT principle (Frequency, Intensity, Time, and Type) (Suharjana, 2018; Syahruddin, 2020). The FITT components are defined as follows: 1) Frequency: This refers to the number of training sessions per unit of time. Achieving fitness typically requires 3-5 sessions per week, with rest days in between to allow for recovery (Irianto, 2006; Syahruddin, 2020).

The 12-minute running test, used as an instrument in this study, demands good cardiorespiratory endurance, running techniques, muscle stamina, and speed. The exercise program, consisting of walking combined with stretching, aimed to strengthen the heart and lungs. The results demonstrated a positive and effective impact on cardiovascular strengthening and participants' overall fitness levels. This is further supported by the t-test results: for the 60-minute walking exercise combined with stretching, a t-value of 5.448 was obtained, which is greater than the t-table value (df 14) of 1.76131, with a significance value of 0.000 < 0.05. This indicates that the intervention effectively improved heart and lung strength. Similarly, the walking exercise with stretching yielded a t-value of 4.379, which is also greater than the t-table value (df 14) of 1.76131, with a significance value of 0.001 < 0.05. These findings confirm the effectiveness of the exercise programs in improving participants' cardiovascular strength and fitness levels.

4. Conclusions

This study demonstrates that a 60-minute walking exercise combined with stretching is effective in improving the participants' heart and lung strength. This is evidenced by the final average result of the 60-minute walking exercise with stretching, which shows an average increase of 205.33 meters.

Conflict of interest

The authors declare no conflict of interest.

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The Effect of *Stakeholder Pressure* on *Sustainability Report* Exposition

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ABSTRACT

There is a phenomenon of increasing demand for transparency in non-financial information, moving towards integrated reporting. Companies are increasingly conducting materiality evaluations to identify and prioritize sustainability issues that are most significant for their business and stakeholders. This research aimed to determine the influence of stakeholder pressure, which consists of investors, creditors, suppliers, and consumers, on the issuance of sustainability reports. This study was quantitative in nature. The data source for this research were secondary data derived from the financial reports of manufacturing sector companies from 2014 to 2021. The data were processed using SPSS version 25. The findings reveal that stakeholder pressure, particularly from investors and creditors, has a significantly positive impact on the issuance of sustainability reports. This indicates that investors and creditors play a crucial role in encouraging companies to publish sustainability reports in each accounting period. Meanwhile, the pressure from suppliers and consumers shows no significant effect on sustainability reporting. This is because suppliers generally tend to prioritize operational aspects and daily business relationships over corporate sustainability reporting. Similarly, sustainability reports are not a primary consideration in consumers' decision-making processes.

1. Introduction

Over the past three decades, there has been an unprecedented increase in the disclosure of non-financial information, such as environmental, social, or sustainability reporting, by private and public companies [1]. Sustainability reporting involves the disclosure and accountability of an organization's performance towards sustainable development to both internal and external stakeholders [2]. According to the Global Reporting Initiative (GRI, 2021), sustainability reporting is defined as "the practice of an organization publicly reporting its economic, environmental, and/or social impacts and its contributions to sustainable development goals." Similarly, the World Business

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Council for Sustainable Development defines sustainability reporting as "a public report prepared by a company to provide an overview of its position regarding economic, environmental, and social activities to both internal and external stakeholders" [3]. Therefore, the purpose of sustainability reporting is to provide accurate and credible reports by companies to stakeholders regarding their environmental and social activities, regardless of the economic impact on the company [1].

Sustainability reporting is the most comprehensive and integrative form of corporate reporting and a voluntary tool that focuses on enhancing corporate transparency regarding social and environmental performance as well as sustainable development [4]. It involves the disclosure of both financial and non-financial information to stakeholders [5]. The goal of sustainability reporting is to provide stakeholders with a clear understanding of a company's values, principles, governance, and management practices [6]. Chouaibi and Affes [7] emphasized that companies with strong social and ethical commitments are typically more involved in environmental disclosures. Existing literature shows that sustainability reporting impacts corporate performance and value [8]. Furthermore, Rezaee and Tuo [9] argue that sustainability reporting improves earnings quality. Additional studies indicate that sustainability reporting reduces debt and equity capital costs [10]. Literature also suggests that sustainability disclosures reduce information asymmetry between companies and their stakeholders [11, 12]. Despite these benefits, some companies, particularly in developing countries, remain reluctant to adopt this practice. While previous research highlights that company and board characteristics are key drivers of sustainability reporting, the findings are inconclusive [8]. On the other hand, evidence suggests that stakeholder pressure and demand can effectively drive the adoption of sustainability reporting [13].

Customer Pressure (CP) refers to the demands expressed by stakeholders, specifically customers. Customers use a company's sustainability information to evaluate its performance. This evaluation helps determine whether the company can fulfill its short-term and long-term obligations to customers. High-quality sustainability information is necessary for customers to make well-informed economic decisions. Customers often maintain long-term business relationships with a company. If a company exits the market, customers must bear significant switching costs. This study focuses on Customer Pressure, which refers to the demands and requirements of end consumers and business customers—key stakeholder groups—for companies to improve their environmental and social performance [14, 15].

Since the 2008–2009 financial crisis, equity ownership and its impact on corporate sustainability have gained importance from the perspectives of research, regulation, and business practice. Equity ownership can be categorized into several types: family ownership, state ownership, managerial ownership, and institutional ownership [16]. This analysis focuses on institutional ownership, based on the assumption that institutional owners possess greater experience and resources, thus influencing corporate strategy. Many institutions act as active owners who monitor the boards of their investee companies and exert pressure on management to enhance corporate sustainability efforts.

Most of these institutions hold highly complex portfolios of companies from an international perspective. Since sustainability issues (e.g., climate change or gender diversity) represent global challenges, institutions are attuned to stakeholder concerns. Investors, whether individuals or institutions, invest in companies based on various considerations, including non-financial performance. Consistent with this, institutional investors actively engaged in sustainability issues have grown rapidly [17, 18].

Creditors refer to lenders who demand high-quality accounting information from private companies to assess credit risk and determine appropriate interest rates [19]. Creditors require both financial and non-financial information to mitigate risks and ensure contracting efficiency [20].

Companies seeking debt funding provide credible and high-quality financial information to reduce their cost of debt capital. Creditors with strong rights have greater incentives to monitor and demand reliable information. Additionally, Ibadin et al. [21] found that companies with relatively high debt ratios in their capital structure tend to produce timely financial reports to meet their obligations. Consequently, creditors demand companies produce high-quality information to reduce information-related risks. On the other hand, companies are motivated to provide high-quality corporate information (including sustainability reporting) to receive favorable evaluations from creditors.

Suppliers influence companies in various ways, including their impact on capital structure decisions. Company debt to suppliers can strengthen the company's bargaining power (its ability to influence other parties) while reducing the bilateral surplus available for discretionary payments to suppliers, such as bonuses and rebates. This weakens suppliers' incentives to maintain relationships with the company [22]. In addition, suppliers can affect a company's capital structure and accounting practices, as well as its sustainability reporting. As stated, "a company is only as sustainable as its suppliers" [23]. Recent developments in Supply Chain Management (SCM) highlight that internal practices provide crucial links with suppliers; without these, companies cannot fully benefit from their supply chain management efforts [24]. Thus, the importance of sustainability issues tied to stakeholder pressure and sustainability reporting serves as a measure of corporate sustainability and performance achievement.

2. Method

2.1. Research Design

This study scientifically addresses research questions using quantitative research techniques, aiming to develop a model that connects theory, previous research, and hypotheses related to the variables used in the study. Quantitative research involves the use of numerical data and aims to test research hypotheses [41]. Quantitative researchers design studies that allow for hypothesis testing. The hypothesized variables depend on or are caused by other variables [42]. The dependent variable is the variable that monitors how subjects react by measuring responses in one or more outcome measures. The independent variable is the variable believed to cause or influence the dependent variable. The dependent variable can be influenced by one or more independent variables [42].

2.2. Research Subjects and Data Collection Techniques

The population of the study consists of manufacturing companies listed on the Indonesia Stock Exchange (IDX) from 2014 to 2021. The data used in this research is sourced from annual report databases accessed from the IDX and the respective company websites. The sampling technique used in this study is purposive sampling. Purposive sampling is a sampling technique based on certain considerations [41]. The reason for selecting purposive sampling is that not all samples meet the criteria set by the researcher. Therefore, the samples chosen are based on criteria determined by the researcher to obtain a representative sample.

The sample criteria used in this study are as follows: (1) manufacturing companies listed on the Indonesia Stock Exchange (IDX) during the study period; (2) companies presenting financial reports in Indonesian Rupiah (IDR); (3) the financial reports of the companies have complete data as required; and (4) the companies have an accounting period that ends on December 31. This research will be conducted from March 2024 to September 2024.

2.3. Operational Definitions and Variable Measurement

2.3.1. Dependent Variable

The dependent variable is the variable that is influenced as a result of the effect of the independent variables used in the research [42]. This study uses the variable Sustainability Report Exposure. Sustainability Report Exposure is defined as a report published by a company aimed at describing the company's activities in the economic, social, and ethical domains, such as addressing climate change, combating poverty, reducing inequalities, and improving product quality sustainably [43]. Therefore, if a company publishes a Sustainability Report, it will be given a value of 1, and if not, it will be given a value of 0.

2.3.2. Independent Variables

Independent variables are the variables that influence the emergence of the dependent variable, i.e., variables that have an impact on the dependent variable [42]. This study includes four independent variables: Investor Pressure, Creditor Pressure, Supplier Pressure, and Customer Pressure.

a. Investor Pressure

Investor Pressure is a variable that measures the demands from investors or shareholders for companies to produce high-quality accounting information. In this study, Investor Pressure is defined as the extent of power or demand exerted by shareholders on the company. Shareholders are defined as those holding the majority ownership percentage in a company. Majority shareholders are those with the authority to monitor the company, owning more than 50% of the shares [44]. The greater the ownership in a company, the higher the oversight to prevent opportunistic actions by management. The formula adopted from Huang & Kung [44] is as follows:

EID_i = % of Majority Shareholder Ownership (1)

b. *Creditor Pressure*

Creditor Pressure in this study refers to the power or demands of creditors on the company. Some creditors or their representatives are included in the board structure and hold strategic positions, enabling them to monitor the company closely by observing the leverage generated [45]. Consistent with Efobi [46], leverage can be used as a monitoring tool to reduce information asymmetry issues. This variable measures the proportion of total debt relative to the total assets of the company. The assumption is that the higher the total debt, the greater the demand for producing high-quality financial information. This is because lenders use earnings quality to assess the company's projected future operating cash flows to meet its obligations. Creditor Pressure is measured as the ratio of total debt to total assets. The formula is as follows [45]:

$DIDi = \frac{Total\ Debt_i}{Total\ Asset_{si}}$ (2)

c. Supplier Pressure

Supplier Pressure refers to the demands from suppliers for the company to provide high-quality accounting information. In this study, Supplier Pressure is defined as the extent of demand or power exerted by suppliers on the company. One indicator of

supplier demand is the value of inventory compared to total assets. In this study, Supplier Pressure is measured using inventory intensity, as applied in the study by Hope et al. [19]. The formula for measuring Supplier Pressure is as follows:

$$SDi = \frac{Total\ Inventory_i}{Total\ Assets_i} \quad (3)$$

d. Customer Pressure

Pressure is defined as the demand or motivation to purchase goods at a certain price level within a specific period. In this study, Customer Pressure is a variable that measures customer demand for high-quality accounting information. Customer Pressure is defined in terms of customer strength, which is reflected in the company's sales as an indicator of customer power. The measurement of Customer Pressure follows the method in Boesso [47], which considers the annual sales volume. Customer Pressure (CD) is measured using the following formula:

$$CDi = \sum Sales \quad (4)$$

2.4. Control Variable

Control variables are variables used to ensure that the results of an experiment can be accurately attributed to the variables being tested, by maintaining other factors or conditions constant. The control variables used in this research are ROA and Size.

a. ROA

ROA (Return on Assets) is one of the most popular profitability measures, representing the ratio between earnings after tax (EAT) and total assets [48]. The use of operating income reflects profitability focused on a company's operations. Information on income is available in the company's income statement, while total assets—listed in the balance sheet—include current assets, fixed assets, and other assets. The ROA measure used in this research is based on Hartarska [49] and Iqbal et al. [50], which compares net income to the company's total assets. The formula is as follows [48]:

$$ROA = \frac{Net\ Income}{Total\ Assets} \quad (5)$$

b. Size

Firm size is a determinant of corporate profitability. A company's profit is influenced by its assets, sales, and market capitalization. Large firms tend to maximize the use of all available resources, whereas smaller firms generate profits proportional to their available resources. The measure of firm size in this research follows Ahmed et al. [51], Arora et al. [52], and Al Azeez [53], which calculates firm size using the natural logarithm of total assets. The formula is as follows:

$$Size = LogN\ (Total\ Assets) \quad (6)$$

2.5. Data Analysis Techniques

The data analysis techniques used in this study include descriptive statistical tests and multiple regression analysis, utilizing SPSS software version 25. Descriptive statistical tests are employed to analyze and describe various characteristics of the data, facilitating the stages of analysis and interpretation [54]. The descriptive analysis in this study consists of the number of observations, minimum value, maximum value, mean, and standard deviation. Additionally, classical assumption tests are conducted to ensure the model is free from deviations or

inefficiencies that could bias the conclusions. These classical assumption tests include normality, multicollinearity, heteroscedasticity, and autocorrelation tests.

2.6. Hypothesis Testing

Hypothesis testing is the primary step in this study to interpret the results based on the collected and observed data. This testing includes partial tests (t-tests), simultaneous tests (F-tests), and the coefficient of determination (R^2). The study tests four hypotheses. The first through fourth hypotheses examine the direct influence of stakeholder pressure—comprising customer pressure, investor pressure, creditor pressure, and supplier pressure—on sustainability reporting.

3. Results and Discussion

3.1. Descriptive Statistical Test Results

Based on Table 1 below, the descriptive statistical results indicate that the sustainability report variable has a minimum value of 0.00, a maximum value of 1.00, a mean of 0.22, and a standard deviation of 0.417. For the investor variable, the minimum value is 0.054, the maximum value is 0.999, the mean is 0.57555, and the standard deviation is 0.229430. For the creditor variable, the minimum value is 0.016, the maximum value is 4.709, the mean is 0.47667, and the standard deviation is 0.365985. The supplier variable has a minimum value of 0.002, a maximum value of 1.625, a mean of 0.20310, and a standard deviation of 0.141190. Next, the consumer variable has a minimum value of 8.669, a maximum value of 14.37, a mean of 12.4435, and a standard deviation of 0.747906. The size variable, used as a control variable, has a minimum value of 25.64, a maximum value of 33.53, a mean of 28.8093, and a standard deviation of 1.607644. Lastly, the ROA variable, also used as a control variable, has a minimum value of -1.46, a maximum value of 0.607, a mean of 0.05066, and a standard deviation of 0.127194.

Table 1. Result of Statistical Descriptive Test

Variable	*N*	Minimum	Maximum	Mean	Standard Deviation
Sustainability Report	560	0.00	1.00	0.22	0.417
Investor	560	0.054	0.999	0.57553	0.229430
Creditor	560	0.016	4.709	0.47667	0.365985
Supplier	560	0.002	1.625	0.20310	0.141190
Consumer	560	8.669	14.37	12.4435	0.747906
Size	560	25.64	33.53	28.8093	1.607644
ROA	560	-1.46	0.607	0.05066	0.127194

Source: Processed Data, 2024

3.2. Normality Test Results

Gujarati [55] stated that: *"...it can be shown that if those are a large number of independent and identically distributed random variables, then with a few exceptions, the distribution of their sum tends to a normal distribution..."*.

This statement suggests that when research data consists of a relatively large sample size, it will naturally follow a normal distribution. Variables classified with n>25n > 25n>25 are considered a large sample [55]. Therefore, the sample size in this study, which is 560, qualifies as a large sample.

3.3. Multicollinearity Test Results

Based on Table 2 below, it can be concluded that there are no symptoms of multicollinearity. This is because all variables in the study show a tolerance value greater than 0.1. Additionally, all variables show a Variance Inflation Factor (VIF) value below 10. Based on the values in the tolerance and VIF columns, it can be stated that the conditions to avoid multicollinearity symptoms have been met.

Table 2. Result of Multicollinearities Test

Variable	*Tolerance*	*VIF*	Conclusion
Investor	0,946	1,038	No signs of multicollinearities
Creditor	0,872	1,147	No signs of multicollinearities
Supplier	0,942	1,062	No signs of multicollinearities
Consumer	0,160	6,235	No signs of multicollinearities
ROA	0,779	5,994	No signs of multicollinearities
Size	0,167	1,284	No signs of multicollinearities

Source: Processed Data, 2024

3.4. Heteroscedasticity Test Results

The heteroscedasticity test was conducted using the Park test. Based on Table 3 above, it can be concluded that heteroscedasticity is not present. Each variable in the study shows a significance value greater than 5%, indicating that the data meets the requirements for heteroscedasticity freedom.

Table 3. Result of Heteroscedasticity Test with Park Test

Variable	t-value	Significance	Conclusion
Investor	0,820	0,412	No signs of heteroscedasticity
Creditor	1,275	0,203	No signs of heteroscedasticity
Supplier	-1,040	0,299	No signs of heteroscedasticity
Consumer	-0,597	0,551	No signs of heteroscedasticity
ROA	0,944	0,346	No signs of heteroscedasticity
Size	1,661	0,097	No signs of heteroscedasticity

Source: Processed Data, 2024

3.5. Autocorrelation Test Results

The calculated values for dL and dU correspond to k=4 and a sample size (n) of 560. From the Durbin-Watson table, Dl is 1.89901, and dU is 1.87094. According to Table 4 above, the Durbin-Watson statistic is 1.973. This value is greater than dU (1.87094) and lies between dU and 4−dU. Therefore, it can be concluded that there is no autocorrelation in the data used in this study.

Table 4. Result of Autocorrelation Test with DW

R Square	*Adjusted R Square*	*Durbin Watson*	Conclusion
0,210	0,208	1,973	No signs of autocorrelation

Source: Processed Data, 2024

Calculation:

dL= 1.84901, dU= 1.87094, 4-dU = 2,12906, n= 560

3.6. Multiple Linear Regression Results

Based on Table 5 below, hypotheses 1 and 2 are supported, while hypotheses 3 and 4 are not. The variables *size* and *ROA* are control variables in this study. As a result, it can be concluded that

investors and *creditors* positively influence the sustainability report, with significance values of 0.048 and 0.009, respectively. The *supplier* variable has a significance value above 5%, specifically 0.212, meaning hypothesis 3 is not supported. Similarly, the *consumer* variable does not positively influence the sustainability report, as its significance value is also above 5%, specifically 0.433.

Table 5. Multiple Linear Regression Test

Variable	t-value	Significance	Conclusion
Investor	1,980	0,048**	Hypothesis supported
Creditor	2,671	0,008***	Hypothesis supported
Supplier	-1,249	0,212	Hypothesis not supported
Consumer	-0,784	0,433	Hypothesis not supported
Size	4,049	0,000***	-
ROA	2,241	0,025**	-
Note: * significance level of 10%, ** significance level of 5%, and *** significance level of 1%.			

Source: Processed Data, 2024

3.7. Coefficient of Determination Test Results

Based on Table 6 below, the adjusted R Square value is 0.142. This indicates that all independent variables used in this study can explain the dependent variable, the *sustainability report*, by 14.2%. The remaining 85.8% is influenced by other variables not included in this study.

Table 6. Results of the Coefficient of Determination Test

R	*R Square*	*Adjusted R Square*	*Standard Error of Estimate*
0,580	0,151	0,142	0,386

Source: Processed Data, 2024

3.8. ANOVA Test Results

According to Table 7 below, the significance value is 0.000. This indicates that the model used in this study is appropriate. When all independent variables are combined, they can influence the dependent variable. Therefore, the ANOVA test requirements are met.

Tabel 7. Hasil Uji ANOVA

Model	F	Significance
Regression	16,444	0,000

Source: Processed Data, 2024

Investors Have a Positive Influence on the Issuance of Sustainability Reports

Investors require transparent and accountable information [56]. When investors receive the expected level of transparency, it can increase their trust in the entity. This condition encourages entities to recognize the importance of issuing sustainability reports. Transparency and accountability provide clarity to investors in deciding whether to invest in the entity. Furthermore, institutional investors, such as pension funds and insurance companies, also consider whether an entity has issued a sustainability report. This becomes a key factor for institutional investors in making decisions. Companies that issue sustainability reports are also perceived as more attractive, positively impacting their reputation [57]. This increases investor interest, as the company is viewed as being responsible for its business activities.

Creditors Have a Positive Influence on the Issuance of Sustainability Reports

Sustainability reports provide information relevant to creditors' needs [58]. Creditors, such as banks and other financial institutions, are highly interested in assessing the financial and credit risks of their borrowers. With sustainability reports, creditors can conduct more comprehensive risk evaluations and make better-informed lending decisions. Creditors often require certain environmental and social standards as prerequisites for lending [59]. Sustainability reports help companies meet these requirements by demonstrating their commitment to sustainability practices and compliance with applicable regulations. Additionally, companies that issue sustainability reports show good social and environmental responsibility, which can help manage reputational risks. Creditors are likely to view these companies as responsible and sustainable partners, making them more inclined to provide long-term financial support.

Suppliers Do Not Have a Positive Influence on the Issuance of Sustainability Reports

Suppliers often lack direct influence over a company's decision to issue sustainability reports [60]. These reports are more frequently driven by stakeholders such as investors, creditors, and shareholders who have direct financial interests in the company. Suppliers generally focus more on operational aspects and day-to-day business relationships rather than on their customers' sustainability reporting [61]. Unless specific contractual requirements or requests related to sustainability are imposed by customers, suppliers are unlikely to actively encourage companies to issue sustainability reports. Suppliers typically function as external entities providing materials or services, and their influence on strategic decisions like sustainability reporting is often minimal. The motivation to issue sustainability reports usually originates from within the company or from stakeholders more closely tied to the company's performance and transparency [62].

Consumers Do Not Have a Positive Influence on the Issuance of Sustainability Reports

Consumers often prioritize price, quality, or convenience as benchmarks for product satisfaction [63]. They tend to evaluate product satisfaction based on whether the product meets their expectations and whether it aligns with the price offered. These factors influence consumer decisions on whether to repurchase from the same brand or switch to a different one. Not all consumers are aware of or knowledgeable about sustainability issues [64]. Without adequate education on the importance of sustainability reports, consumers may not prioritize or inquire about them. If sustainability is not a key factor in their purchasing decisions, companies may not feel a strong incentive to issue sustainability reports. Overall, while consumers can play a role in promoting transparency and sustainability, their influence is not always strong or direct enough to drive companies to issue sustainability reports.

4. Conclusions

Sustainability reports are essential as they provide clear information for stakeholders. The stakeholders examined in this study include investors, creditors, suppliers, and consumers. The results indicate that investors and creditors positively influence the issuance of sustainability reports. This highlights the importance of stakeholder involvement in encouraging companies to issue sustainability reports regularly. However, suppliers and consumers do not have a positive influence on the issuance of sustainability reports. This is because suppliers generally focus more on operational aspects and day-to-day business relationships rather than on the sustainability

reporting of their customer companies. Additionally, consumers do not demand information from sustainability reports. Instead, they tend to prioritize products with the best quality and affordable prices, regardless of whether the company publishes sustainability reports.

For future research, it is recommended to conduct analyses on an international scale. This could involve comparing the influence of stakeholders on the issuance of sustainability reports across different countries or industries. It would also be beneficial to examine how factors such as culture and markets impact sustainability reporting. Future research could also consider the role of technology and digitalization to determine whether these factors enhance stakeholder engagement and increase their influence on sustainability reporting.

Conflict of interest

The authors declare no conflict of interest.

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Developing a Body Treatment E-Book as a Learning Media for the Body Care Course

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ABSTRACT

This study aimed to identify the design, development, supporting, and inhibiting factors of a body treatment e-book as a learning medium for the Body Treatment course. The e-book development employed the ADDIE model, which included five stages: analysis, design, development, implementation, and evaluation. This e-book is expected to facilitate students in understanding body treatment materials more effectively and interactively, enabling them to independently practice the skills they have learned. Validation by media and content experts indicates that the e-book is appropriate for use, with feasibility percentages of 95.3% and 95.1%, respectively. The try-out conducted with students also yielded excellent results, with an average feasibility percentage of 92.2%. This development makes a significant contribution to improving the quality of learning, enhancing accessibility to educational resources, and strengthening students' comprehension of body treatment materials.

1. Introduction

Learning technology as a discipline, study program, or profession continues to develop rapidly. This progress is characterized by four main features: (1) a systems-based approach, (2) utilization of diverse learning resources, (3) improvement in the quality of human learning, and (4) individual instruction focusing on action-based outcomes (Suparman, 2004: 30-31). According to Miarso (2004: 201), this growth stimulates and strengthens professional development in the field of learning technology. E-books, as part of learning technology development, play a significant role in creating and using digital learning materials. In the are of development, training technologists analyze existing learning issues to design effective learning environments.

The selection of e-book media enables the delivery of material in a detailed manner within a limited timeframe. Sanjaya and Restiyowati (2012) state in their book that an e-book is a textbook converted into a digital format, functioning as a learning medium equipped with applications that include multimedia databases and various learning resources, preserving the multimedia presentation of subjects in book form. E-books have undergone significant development, becoming

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more interactive and evolving into what is now referred to as interactive e-books. The use of interactive media, such as e-books, allows learning activities to focus more on students and facilitates interaction between students and the e-book (Zhang, 2005). Once appropriate media technologies are developed to meet needs, it is advisable to integrate them into the learning process where educational technologies are introduced. The usage domain refers to the application of such technologies, requiring skilled technicians to implement the media for educational purposes. It also involves technical experts who assess the validity and effectiveness of the media. Once validated, the media can then be released for public use.

One example is a learning environment presented in an attractive format that can be accessed repeatedly without limitations of space and time, known as an e-book (Suwarno, 2011). While traditional books typically consist of collections of paper containing text or images, e-books store digital information that may also include text or images. Suarez (2013) argues that e-books can be regarded as educational materials designed for use on digital devices, often incorporating images, text, and animations that can be viewed on electronic devices. E-books are one of the interactive learning tools for delivering information as they can present multimedia illustrations effectively.

According to Mukmin and Zunaidah (2018), interactive multimedia is chosen to optimize the available technical skills and provide effective learning innovations for students. Additionally, Sanjaya and Restiyowati (2012) argue that an e-book is a textbook that can be converted into a digital format, serving as a learning environment with applications containing multimedia databases, various learning resources, recordings, and multimedia presentations.

The Body Treatment course consists of 2 credits and covers comprehensive body care, including treatments for the back, chest, abdomen, buttocks, legs, and arms. This course also includes techniques for hair removal on the legs, arms, and armpits, mastery of various cosmetics used in body care, personal therapist management, and occupational health and safety (K-3) control in body treatments. To support this material, it is essential to develop instructional resources that are easy to understand, accessible, and learnable for students in the Cosmetology program. Therefore, it is highly feasible to package this Body Treatment e-book as a guide containing step-by-step body care instructions, an online learning environment serving as an additional reference for beauty students, and a resource for the broader community interested in learning or deepening their knowledge.

2. Method

2.1. Type of Research

The Research and Development (R&D) ADDIE model is the method employed in the development of the Body Treatment e-book. According to Mulyatiningsih (2016), the model consists of five steps: analysis, design, development, implementation, and evaluation. The method or model used in this research aims to develop an electronic product that has been tested for its validity, practicality, and efficiency through the Body Treatment e-book.

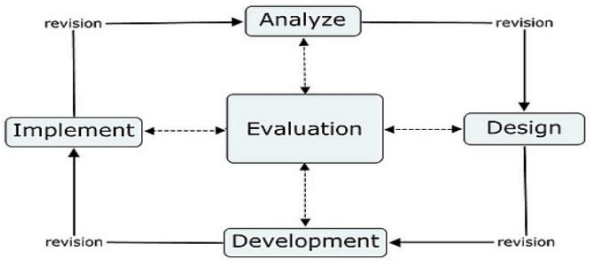

Figure 1. ADDIE Model (Mulyatiningsih, 2016)

2.2. Research and Development Procedure

The research and development procedure follows the model developed by Robert Maribe Branch. Based on its educational philosophy, the implementation of the ADDIE model must be student-centered, innovative, authentic, and inspiring. The stages within the ADDIE model are interconnected, requiring the model to be applied gradually and comprehensively to ensure the creation of an effective learning product.

This development follows the procedure developed by Robert Maribe Branch, which consists of five steps. These five steps are: Analysis, Design, Development, Implementation, and Evaluation. Based on these steps, a more detailed explanation is provided to facilitate understanding, as follows:

1. **Analysis**: The analysis step consists of two stages: performance analysis and needs analysis. The first stage, performance analysis, is conducted to identify and classify the issues faced at the campus related to the learning media currently used, and then find solutions by improving or developing the learning media. The second stage, needs analysis, involves determining the learning media required by students to enhance the quality of learning and improve their academic performance.
2. **Design**: The second step is design, which can be compared to constructing a building—before it is built, a blueprint must first be created. In this learning media, the design process is considered from three perspectives: design, content, and language. Once the design is finalized, the next step is to develop the learning media.
3. **Development:** The third step involves developing the learning media based on the initial design. The stages undertaken by the researchers in developing the e-book media are as follows:
    a. Creating the learning media using the AnyFlip application. The e-book is developed with a focus on design, content, and language, ensuring it differs from the learning media used in the classroom.
    b. Reviewing the learning media by validating it with a team of media, content, and language experts.
    c. Revising the learning media based on feedback and suggestions from the team of media, content, and language experts, resulting in a comparison between the initial media and the revised version.
4. **Implementation:** This step involves implementing the learning media in the teaching process at schools. It includes conducting small-scale and large-scale tryouts involving students to assess their responses and the appeal of the e-book learning media.
5. **Evaluation:** Based on the implementation phase, the e-book needs to be evaluated. During the evaluation stage, final revisions are made to the developed product based on feedback and suggestions provided by students during the implementation phase.

2.3. Validation Stage

During the validation phase, there are two types of validation: content validation and media validation:

1. Content Expert Team
   At this stage, corrections were made to obtain data on the product's feasibility, assessed from the content perspective in terms of learning objectives (SK and KD), presentation aspects, and the techniques used to present the product content. Content validation was conducted by experts in the field of Body Treatment. The data collected were then analyzed and used to revise the development process of the interactive e-book-based learning media.
2. Media Expert Team
   In this stage, corrections were made to the media used in terms of its design, conducted by media experts. The data collected was analyzed and used to revise the development of the interactive e-book-based learning media. After revising the product, the researchers conducted a re-validation to obtain an evaluation of whether the product falls into the "feasible" or even "highly feasible" category for use in student learning on campus.

2.4. Testing

The testing phase is divided into two stages:

1. Small-Scale Testing: The small-scale testing phase was conducted at Universitas Negeri Yogyakarta, involving 10 students from the Cosmetology Study Program.
2. Large-Scale Testing: The large-scale testing phase was conducted at Universitas Negeri Yogyakarta, involving 30 students from the Beauty and Cosmetology Study Program.

2.5. Data Collection Instruments

The instruments used for data collection in this research include questionnaires, interviews, observations, and documentation.

1. Questionnaires
   Questionnaires are tools used to collect and record data or information by providing a set of questions to respondents, specifically students from the Cosmetology Study Program, as well as validators, to be answered according to the user's requests. The questionnaire method is used to measure program indicators related to content, language, and media.
2. Interviews
   Interviews are a form of evaluation tool conducted through conversations and question-and-answer sessions with respondents to obtain information needed by the researcher. In this study, the researcher conducted interviews with students from the Cosmetology Study Program to collect data and explore deeper information about the potential and challenges present in schools.
3. Observation
   Observation is a process of systematically, logically, objectively, and rationally observing and recording various phenomena to achieve specific goals. Observations were carried out in a non-systematic manner without using structured observation instruments. The observations involved directly observing classroom learning activities to analyze the learning media used by teachers to support the learning process.
4. Documentation
   Documentation refers to records of past events. In this study, documentation included photos and written materials from students in the Cosmetology Study Program

during the learning process using interactive e-book-based learning media and during the completion of the learning media evaluation questionnaire.

3. Results and Discussion

3.1. Result

The development research of the *Body Care E-Book* utilized the ADDIE research model developed by Robert Maribe Branch, which consists of five stages: analysis, design, development, implementation, and evaluation. The ADDIE development model was chosen because its development procedure aligns well with the product to be created, namely instructional media with guidelines for effective design in the development of learning materials. The primary objective of using this development model is to design and develop a product that is both effective and efficient.

1. Analysis

   At this stage, problem analysis and needs analysis were conducted. In the problem analysis, a preliminary study was carried out on students of the Cosmetology Study Program at the Faculty of Vocational Studies of Universitas Negeri Yogyakarta (UNY). This stage involved analyzing learning media, learning achievements, and learning outcomes of the *Body Treatment* course in accordance with the curriculum used. The results of this analysis served as a guide and consideration in developing the *Body Treatment E-Book*.

   The needs analysis focused on determining the learning media required by students to enhance the quality of learning and student competence. Both students and lecturers require a more interactive learning resource to facilitate better understanding and practical application. Therefore, the *Body Treatment E-Book* was developed to enable students to study and practice independently after class, anytime, and anywhere. Ideally, the *Body Treatment E-Book* will serve as an interactive learning medium that introduces variety into the learning process, actively involving students. This *Body Treatment E-Book* integrates audio, text, images, animations, videos, music, and interactive quizzes as evaluations, providing richer information than traditional books or primary learning resources.

2. Design

   In designing the e-book, a literature study was conducted to search for reference sources related to the learning achievements and learning outcomes of the *Body Treatment* course. This literature study aimed to examine the content components of the digital book to be developed. An e-book (digital book) is a publication medium that includes text, images, and audio, presented in digital format, and accessible on computers or other electronic devices such as Android smartphones or tablets (Qibtiya & Kustijono, 2018). The e-book components must minimally include: (1) a preface, (2) a table of contents, (3) the main body of the book divided into chapters or sections with learning objectives, (4) a bibliography, (5) a glossary, and (6) an author bio/about the authors.

   The material is organized neatly with an attractive layout, featuring original photos and sketches to support the content, making it easier for readers to understand the material presented. The content framework includes the design of step-by-step

procedures for performing body care using both traditional and modern techniques, which will serve as the e-book content.

The design of the *Body Care E-Book* as a learning medium begins with creating a format that includes an introductory section consisting of two parts. The first part is the cover, titled *Body Treatment*. The second part is a menu containing the following sections: Preface, Table of Contents, Introduction (Basic Competencies, Learning Outcomes, Instructions, and General Explanation), Material, Evaluation, References, and Author Biography.

In creating the e-book script, the content framework was structured to include the front page, book identification, general guidelines, concept map, table of contents, and material divided into five chapters. The selection of materials was based on the needs of the readers. Additionally, a closing section was included, summarizing all the material. The following e-book script was created as a layout based on the e-book design template.

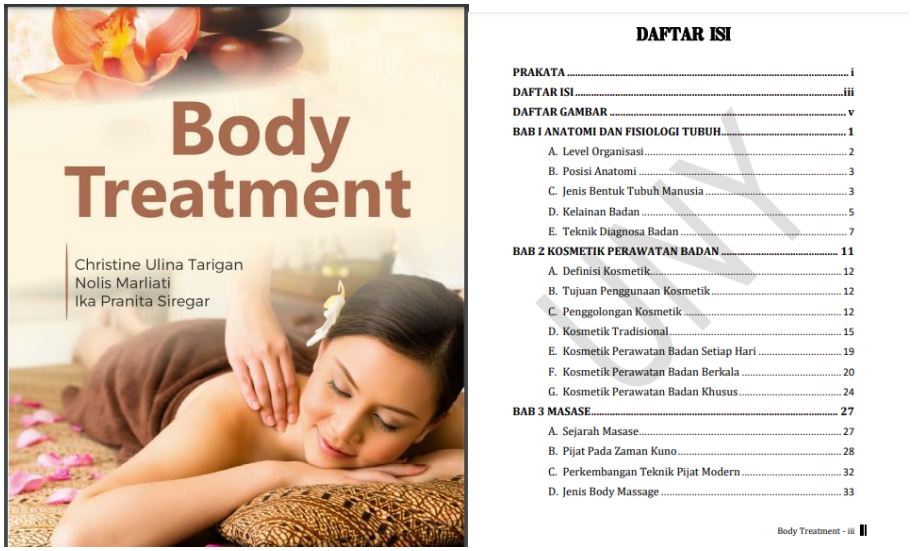

Figure 2 Cover and Table of Contents of E-book Body Treatment

3.2. Discussion

The development of the *Body Treatment* e-book as an interactive electronic (non-printed) medium aims to serve as a supplementary learning resource for the *Body Treatment* course and to enhance students' reading interest through an audio-visual presentation. The medium is developed in the form of an electronic book accessible via laptops, making it easy to use and practical.

The decision to develop an e-book instead of a flipbook, conventional book, or other media was based on its ability to keep readers more focused on the content, as it avoids excessive animations and distractions. Additionally, e-books can be accessed through digital devices such as laptops, smartphones, and computers (Sabtaningrum et al., 2020), making reading activities more efficient and effective.

The majority of students spend their time using electronic devices for playing games and social media rather than using their time for reading books. Therefore, an *E-Book* as a learning medium utilizing electronic devices can be developed. The development of this product follows the procedure established by Robert Maribe Branch, using the ADDIE research model. This model consists of five stages: Analysis (needs analysis and task analysis), Design (product

design), Development (product development), Implementation (product implementation through small and large group trials), and Evaluation (product evaluation).

The results of the *Body Treatment* e-book development identified supporting and inhibiting factors, including:

a. Supporting factors; 1) **Technology**: Developing a digital book in the current era is highly appropriate, as it simplifies the process of designing an e-book using applications that offer extensive functionality and limitless design options. 2) **Creativity**: Creativity is crucial in e-book development, particularly in designing the layout, and placing text and images effectively. 3) **Accessibility of Anyflip**: The e-book can be accessed via digital devices anytime and anywhere using Anyflip.
b. Inhibiting factors: 1) **Cost**: Developing the *Body Care* e-book involves creating content by conducting practical activities, which requires additional support, such as hiring photographers for content creation. Other costs include renting costumes and a photo studio. 2) **Validation Revisions**: During the development process, several revisions were necessary to improve the e-book and make it more acceptable to readers. 3) **Book Editing**: The editing process posed challenges. 4) **Anyflip Accessibility**: The free version of Anyflip caused delays in access, due to the presence of advertisements and navigation features that did not function properly when the e-book was uploaded to the platform.

The use of e-books to support learning in *Body Treatment* can be an effective way to increase students' desire, interest, and motivation. It is also considered capable of providing psychological support and clarifying what has already been explained by the lecturer. Additionally, e-books can be accessed and studied anytime and anywhere.

According to Wenny Wijayanti (2015), interactive teaching materials are a combination of two or more media (audio, text, graphics, animation, and video) that users can manipulate or interact with to control commands or the natural behavior of a presentation. Meanwhile, Prihantana (2015) highlights that the benefits of interactive teaching materials using multimedia technology enable students not only to hear (engaging the sense of hearing) but also to see (engaging the sense of sight). The more senses involved in receiving and processing information, the greater the likelihood that the information will be understood and retained in memory.

The feasibility test of the development of the Body Care e-book was carried out in the assessment stage by material experts and media experts. This is to the theory put forward by Setyono (2013) in his research showing that the learning media developed as an e-book has very good criteria based on the assessment of material experts and media experts with an average of 86.56%. The validation results obtained from material experts were 95.1% with a very feasible category. The average percentage of media experts was 95.3% with a very feasible category, thus the development of the Body Care ebook can be said to be very possible to be used to support learning in the Body Care course.

The revisions given by the material and media validator correct errors in the product to be developed, so that updates are needed if there is new knowledge related to the Body Care material. In addition to being said to be feasible for the development of the Body Care e-book, it can also be accepted by users, namely Cosmetology students. In the recapitulation of the user test results, the category is very feasible. This is proven because each aspect that was tested was categorized as very feasible, with results in the aspect of material quality at 92.58%, in the aspect of grammar at 91.17%, in the aspect of media quality at 92.17% in the aspect of usability of 93.33% and the aspect of accessibility of 91.83%. From all aspects, the results of the user test

with the panelists obtained a percentage of 92.2% with a very feasible category. This assessment was carried out by covering aspects of material quality, grammar, media quality, usability, and accessibility in the development of the Body Care e-book. The results of the user test were distributed to the category of make-up and beauty students. After the user test, the next stage is to disseminate it by creating online e-book access by uploading it to the URL of anyflip website.

4. Conclusions

The design of the e-book development was carried out by analyzing problems and needs to obtain material analysis. Problem analysis was conducted through observation, interviews, and documentation, while needs analysis was based on the findings from the problem analysis. The results of the problem and needs analysis indicated the following: a) Limited sources of information, both printed and digital, discussing Body Treatment and practical techniques. b) Students' lack of interest in using printed books. c) Low student motivation for independent learning using books anytime and anywhere.

The development of the e-book involved creating a concept and framework, drafting the e-book, and designing it to conduct a product feasibility test. The results of this feasibility test were validated by experts, including media experts and material experts. The validation results from media experts showed a score of 95.3%, categorized as "very feasible." Similarly, the material validation scored 95.1%, also categorized as "very feasible." User testing with 30 panelists resulted in an overall percentage of 92.2%, categorized as "very feasible." After processing the data, the e-book product is ready to be disseminated online.

There are supporting and inhibiting factors in the development of the *Body Treatment* e-book. The supporting factors include: 1) Technology – developing a digital book in today's era is highly appropriate, as it simplifies the design process with applications offering numerous functions; 2) Creativity – creativity is essential in designing the e-book, particularly in arranging layouts, and placing text and images; 3) Anyflip accessibility – Anyflip can be accessed via digital devices anytime and anywhere. On the other hand, the inhibiting factors include: 1) Cost – creating content for the *Body Care* e-book required practical activities and additional assistance, such as hiring photographers, as well as renting costumes and photo studios; 2) Validation revisions – the development process required multiple revisions to improve the e-book and make it more acceptable to readers; 3) Anyflip accessibility issues – the free version of Anyflip caused delays in access, displayed numerous ads, and included navigation issues that hindered optimal functionality when the e-book was uploaded.

Conflict of Interest

The authors declare no conflict of interest.

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Integrating Solar Power System and Smart Home: Energy Efficiency and Sustainability Increase a Review Article

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ABSTRACT

The combination of solar energy systems and smart home technologies offers great potential to improve energy efficiency and support sustainable development. It is urgently needed, particularly in Indonesia, where increasing electricity demand presents both challenges and opportunities. This literature review examines how the integration of these technologies can contribute to reducing energy consumption, promoting sustainable lifestyles, and meeting Indonesia's renewable energy targets. Some key components of integration, namely energy management, automation, and system interoperability, were explored in this review. In addition, the review also highlights the benefits, including financial savings, increased energy autonomy, and reduced carbon emissions. It is believed that implementing solar energy systems and smart home technologies will help change into cleaner energy while improving household energy security.

1. Introduction

As a developing country with rapid economic growth, Indonesia, faces major challenges in meeting increasing energy demand while reducing dependence on fossil fuels [1]. To date, most power plants in Indonesia still rely on coal and natural gas, which contribute to high greenhouse gas emissions and have negative environmental impacts [2]. To meet the net zero emission target by 2060, Indonesia needs to accelerate the transition to renewable energy, namely as solar power [3].

Indonesia, located in the equator area, has abundant sunlight throughout the year, so solar energy has great potential in this country [4]. However, despite this potential, solar energy penetration in the residential sector is still relatively low [5]. Integrating solar power systems with smart home technology offers a way to address energy challenges by increasing efficiency and enabling energy independence at the household level [6].

This literature review aims to explore the potential of integrating solar power systems with smart homes in Indonesia, with a focus on its impact on energy efficiency and sustainability. Some key questions that are the focus of this review include:

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- What are the latest technological developments that support the integration between solar power and smart homes?
- What are the main benefits of implementing such integration, especially in the Indonesian context?

By exploring relevant literature, this review aimed to provide insights into how Indonesia can improve solar and smart home technologies to achieve its future energy and sustainability goals. The results of the analysis are expected to serve as a guideline for stakeholders in designing more effective policies and strategies to support the energy transition.

2. Method

This literature review aimed to explore and synthesize existing research on solar and smart home integration, specifically in the Indonesian context. The methodology used in this review is presented as follows.

• Collecting literature published from 2010 to 2024 to capture the latest developments in solar and smart home technologies

The researchers focused on collecting studies relevant to Indonesia, reviewing local case studies, government policies, and market trends. The aim was to identify how these technologies can be effectively integrated to improve energy efficiency and sustainability in Indonesian households.

• Analyzing the collected studies using the qualitative approach

The analysis aimed to identify common themes, challenges, and solutions related to solar and smart home integration in Indonesia. Key factors being considered were technological innovation, economic viability, environmental impact, and social acceptance. This thematic analysis was expected to provide insights into potential future developments and areas for further research.

3. Results and Discussion

3.1. Results

3.1.1. Solar Power System and Smart Home Technology

Solar Power Generation Systems (SPGS) and Photovoltaic (PV) panels convert sunlight into electricity, providing a renewable energy solution that is in line with Indonesia's commitment to reducing carbon emissions [7]. The Indonesian government has set an ambitious target to increase the contribution of renewable energy to 23% in the national energy mix by 2025 [8]. With a population of over 270 million and abundant sunshine throughout the year, the potential for solar energy utilization in Indonesia is enormous [9].

Fig. 1. Solar power system on the roof of the house, with photovoltaic panels and energy monitoring system

However, the adoption rate of SPGS in the residential sector is still low. The main challenges are high initial investment costs, limited public awareness, and inadequate infrastructure [10]. To overcome these issues, the government has introduced various policies, such as feed-in tariffs and net metering schemes, to encourage the adoption of solar energy among the public [11]. In addition, more technology is developed, such as more affordable PV panels and efficient battery storage systems [12].

The concept of smart homes is also increasingly popular in Indonesia, especially in urban areas such as Jakarta, Bandung, and Surabaya, where the adoption rate of digital technology is quite high [13]. Smart home technology combines Internet of Things (IoT) devices to automate and optimize various household functions, such as lighting, air conditioning, and security systems [14]. Smart meters and energy management systems allow homeowners to monitor energy consumption, providing insights that can lead to significant savings [15].

However, there are still challenges in adopting smart homes in Indonesia [16]. In addition to the relatively expensive cost of devices, low awareness of the benefits of smart homes and limited reliable internet infrastructure are major obstacles [17]. In addition, cultural resistance to new technologies can also affect acceptance in society [18]. Therefore, public awareness campaigns and government incentives are needed to increase public understanding of the benefits of smart homes, especially in the context of their integration with solar power systems [19].

3.1.2. Integration between Solar Power and Smart Homes

The integration of solar power plants with smart home technology in Indonesia offers potential benefits that can improve energy efficiency and sustainability [20]. By utilizing solar energy for household needs, homeowners can reduce dependence on the electricity grid, as well as reduce energy costs and carbon footprints [10]. Smart home systems can optimize solar energy use by setting devices to operate during periods of high solar power production and utilizing batteries efficiently [21].

Fig. 2. The interior of a smart home with IoT devices and energy control through application

As these two sectors grow, collaboration between solar energy providers and smart home technology developers is becoming increasingly important [22]. For example, integrating energy management systems with solar cells can help households maximize renewable energy utilization and ensure a stable electricity supply during blackouts or peak demand periods [23].

3.2. Discussion

3.2.1. Key Aspects of Integrating Solar Power Systems and Smart Homes

The integration of solar power systems with smart home technology includes several key factors that are very relevant to Indonesia. In addition to contributing to energy efficiency, this integration can support sustainability and energy security amidst increasing national energy demand [24]. Several key aspects of this integration process include:

3.2.2. Technology Compatibility

The success of the integration of PV and smart home technology is highly dependent on the compatibility between the systems [25]. In Indonesia, technological developments in both sectors are essential to support effective integration. Devices such as smart meters, energy management systems, and Internet of Things (IoT) devices must be able to operate well with solar inverters and battery storage systems [26]. With this compatibility, users can monitor and control household energy consumption efficiently. Standardization of communication protocols is also needed so that devices from different manufacturers can be interconnected and operate together without any obstacles [27].

3.2.3. Framework of Policies and Regulations

Supportive policies and regulations play an important role in accelerating the integration of solar and smart homes in Indonesia [20]. Currently, the government has introduced various policies, such as the Renewable Energy Law and net metering regulations, to encourage the use of renewable energy [28]. However, additional regulatory frameworks are needed to clarify the rules related to the use of solar-based smart home technology. Policies that focus on energy efficiency, such as energy labeling programs and tax incentives for smart devices, can further increase adoption by the community [29].

3.2.4. Economy

Economic feasibility is an important factor for households in Indonesia in considering the integration of solar power systems and smart homes [26]. Although the cost of solar technology is increasingly affordable, the high initial investment costs remain a significant barrier [30]. To overcome this challenge, financing models such as leasing and power purchase agreements (PPAs) can be a solution for consumers. In addition, the financial benefits of reduced electricity bills and government incentives can make this integration more attractive and economically feasible in the long term [31].

3.2.5. Awareness and Education

Raising public awareness about the integration of solar power systems and smart home technology is critical to improving energy efficiency in Indonesia. Many homeowners remain unaware of how smart homes can optimize energy use, underscoring the need for educational campaigns that leverage public media, workshops, and community programs to spread knowledge about this technology. Collaboration with community leaders and influencers can further strengthen outreach efforts, encouraging greater public engagement [32]. The integration of solar photovoltaic systems in smart homes not only provides a reliable source of energy but also increases automation and control over the home environment, thus leading to significant energy savings [33]. Smart systems can reduce daily energy consumption for lighting and air conditioning, demonstrating the tangible benefits of this technology [34]. Then, by leveraging mobile technology, awareness about sustainable living practices can be raised to ultimately promote a more environmentally friendly lifestyle [35] [36].

3.2.6. Local Market Conditions

A comprehensive understanding of local market conditions is critical to the effective implementation of solar and smart home technologies in Indonesia, especially given the varying energy needs of urban and rural areas. In rural areas, where the electricity grid is often unreliable or non-existent, off-grid photovoltaic (PV) systems present a viable solution, demonstrating

competitive levelized energy costs compared to diesel generators and micro-hydro systems [37][38]. Conversely, urban areas may benefit more from grid-connected solutions that improve energy efficiency and reduce electricity costs [39]. The integration of smart home technologies can further optimize energy consumption, but public awareness remains low, demanding education and community engagement initiatives to foster understanding and adoption [40][41]. Sustainable business models and local participation are critical to overcoming barriers to technology adoption, ensuring that these renewable energy solutions are not only implemented but also effectively maintained [40][41].

3.2.7. Climate Resilience

The integration of solar power systems and smart home technologies significantly improves climate resilience in Indonesia, especially in the face of increasing extreme weather changes. Households equipped with these systems can effectively manage energy needs during crises, leveraging battery storage for backup power during blackouts and energy management systems to optimize usage during shortages [42][43]. For example, the SUNPO (Sun Power) device combines solar power generation with a backup system to ensure reliable electricity supply in disaster-stricken areas, facilitating communication and lighting [44]. In addition, advanced technologies such as smart grids and machine learning can predict energy demand and optimize distribution, reducing reliance on centralized grids and increasing resilience to disruptions [45][46]. This multifaceted approach not only ensures energy availability in remote areas but also contributes to a more sustainable and equitable energy landscape, essential for adapting to the impacts of climate change [42][43].

3.2.8. Benefits of Integration

The integration of solar power systems with smart home technology in Indonesia offers significant advantages, especially in improving energy efficiency and achieving cost savings. Smart home systems, such as those using the ESP32 microcontroller, enable real-time monitoring and control of energy consumption, leading to reduced energy use for lighting and air conditioning [34]. Furthermore, the integration of Internet of Things (IoT) technology facilitates intelligent automation, allowing users to optimize energy use and minimize environmental impact through real-time data analysis [36]. Furthermore, advanced energy management strategies can enhance photovoltaic (PV) self-consumption by rescheduling equipment to operate during peak solar power generation, resulting in substantial reductions in electricity costs and grid dependency [47]. Overall, these innovations not only promote sustainable living but also contribute to broader social and environmental goals in Indonesia [48 [49].

3.2.9. Improved Energy Efficiency

One of the most prominent benefits of this integration is increased energy efficiency [6]. By using solar power for household needs, dependence on electricity from the main grid can be significantly reduced [50]. Smart home technologies, such as Internet of Things (IoT)-based energy management systems, allow real-time energy consumption monitoring and adjusting usage as needed [51] [52] [53]. This is especially relevant in Indonesia, where electricity demand continues to increase every year. The increase in energy efficiency not only reduces the burden on the national electricity grid, but also helps prevent the risk of blackouts [54].

The integration of solar power with smart home technology significantly improves energy efficiency, especially in areas such as Indonesia where electricity demand is increasing. By using IoT-based energy management systems, homeowners can monitor and adjust their energy consumption in real-time, thereby reducing dependence on the main grid and reducing the risk of blackouts [36] [47]. For example, a system using the ESP32 microcontroller allows for lighting and temperature control, leading to substantial energy savings, such as reducing daily lighting consumption from 0.17 kWh to 0.12 kWh [36]. In addition, predictive algorithms can optimize energy distribution by

anticipating fluctuations in solar power generation, further increasing efficiency and allowing users to sell surplus energy back to the grid [47]. This convergence of solar energy and smart technologies not only promotes sustainability but also fosters a resilient energy infrastructure that is able to adapt to a variety of household needs [55][56][57].

3.2.10. Cost Efficiency

In addition to increased efficiency, the integration of solar power and smart homes also provides benefits in the form of cost savings [53]. Amid rising electricity rates in various urban areas in Indonesia, the use of solar energy allows for significant reductions in monthly electricity bills [58]. Smart home systems can further optimize energy use by automating equipment to operate during peak solar power production hours, maximizing the use of renewable energy [59]. In addition, the Indonesian government has introduced various incentives, such as tax breaks and subsidies for renewable energy installations, to increase the economic feasibility of implementing this technology [60].

3.2.11. Environmental Sustainability

Indonesia faces several environmental challenges, including deforestation and air pollution due to high consumption of fossil fuels. Integrating solar power and smart home technology can help reduce greenhouse gas emissions by reducing the use of fossil fuels [61]. By promoting renewable energy, households are supporting the efforts to achieve carbon neutrality and preserve the environment [1] [62]. This step is in line with global initiatives to combat climate change and strengthen Indonesia's position as a leader in sustainable development in the ASEAN region.

3.2.12. Energy Independence

Integrating solar power with smart homes has the potential to increase energy independence for households in Indonesia, especially in rural and remote areas [63]. By producing their own electricity, families can reduce their dependence on the main electrical grid, which is vulnerable to energy price fluctuations and supply disruptions [64]. This energy independence is especially important for communities with limited access to electricity, allowing households to maintain a stable supply for basic needs such as lighting and communications [65].

4. Conclusions

The integration of solar power systems and smart home technologies provide a significant opportunity for Indonesia to improve energy efficiency, promote sustainability, and enhance the quality of life for its people. As the country grapples with rising energy demand, environmental issues, and economic challenges, this integration aligns with Indonesia’s national goals to increase the use of renewable energy and sustainable development. The integration of solar power systems and smart homes has the potential to transform Indonesia’s energy landscape, contributing to a more sustainable, resilient, and prosperous future for all its people. The use of these technologies will be critical in addressing the pressing challenges posed by climate change and energy insecurity.

Conflict of interest

The authors declare no conflict of interest.

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Increasing Teacher Competency through Training on Non-Destructive Testing Methods for Welding (NDT) for Teachers in Kulonprogo Regency

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ABSTRACT

The purpose of this community service is to provide knowledge and skills related to the method of non-destructive testing for welding (NDT). It is expected that all participants will be able to independently carry out non-destructive testing of welding results that will be taught to vocational high school students in Kulon Progo Regency. This community service was conducted through lecture, discussion, simulation, and asssited practice. Those activities were done to make it easier for participants to understand the materials presented. After all the activities were completed, an evaluation was carried out on both the ability and understanding of partners and the evaluation of the activities that have been carried out. The results of this activity show that before participating in the training participants ability related to non-destructive testing of welding results is low. Then, after the program was carried out, there is a significant increase in mastery of the theory and practice of welding testing, ranging from visual testing, penetrant fluids, magnetic tests, to ultrasonic tests.

1. Introduction

Teachers cannot rely solely on the skills acquired during college or past experience in carrying out teaching duties. The ever-changing world of education demands them to always be ready to respond to new dynamics [1]. Adaptation is important because teacher performance plays a very vital role in determining the quality of education, both in terms of the process and student learning outcomes [2]. In this role, teachers not only deliver material, but must also be able to plan, implement, and assess learning effectively to achieve optimal educational outcomes. The quality of learning produced by teachers directly affects students' abilities and contributes to improving the overall quality of education [3].

To respond to the demands of changing times, improving teacher competency is a crucial factor. This improvement includes the development of skills, attitudes, and abilities that must be continuously honed [4]. In facing the challenges of the modern world, teachers need to be able to adapt to technological, social, and cultural developments that affect students' learning methods.

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Changes in student characters also require teachers to be more flexible in understanding the needs and uniqueness of their students. The principles of professionalism and lifelong learning are important foundations for teachers to remain relevant and qualified in their roles as educators [5]. However, although teacher competency improvement is essential, various issues may be faced by the teachers. Limited resources such as time and budget are the main challenges. The teaching tasks, coupled with administrative burdens, make time for self-development increasingly limited [6]. In addition, access to quality training is often limited by cost, location, or the availability of appropriate programs. Teachers' motivation to continue to develop also varies, with some teachers feeling quite satisfied with the abilities they already have, while others strive to continue learning and improving their skills. Support from schools, colleagues, and other related parties is essential to overcome these issues, especially in dealing with changes in curriculum or education policies that require adjustments from teachers [7].

As a concrete example, welding engineering teachers in Kulonprogo Regency face major challenges in developing their competencies. The heavy workload and limited budget for training are the main issue. One proposed solution is to get training in the field of welding results inspection using non-destructive methods (Non-Destructive Testing/NDT). This effort important because it allows teachers to master welding testing techniques that comply with modern industry standards. By participating in this training, it is hoped that teachers can improve their technical competencies, so that they can integrate the latest technology into the learning process at school. Ultimately, this training aims to improve the quality of welding engineering education, prepare students with relevant skills to get into the workforce, and increase the competitiveness of vocationa high school graduates in the future.

2. Method

This community service consists of two main parts, namely training and mentoring. In the training, participants were taught methods of inspection and testing of non-destructive welding results (NDT). The testing methods provided include:

2.1. Visual testing

The participants were provided with the theory and practice of visual inspection of welding results regarding welding defects [8Defects were identified and then studied during the pre-, during, and post-welding processes. With the ability to carry out visual observations, it is hoped that analytical skills will improve as welding technique skills.

2.2. Testing with penetrant fluid,

Inspection was done after participants learned to inspect visually [9]. The training participants learned theories of inspection with penetrant fluid, recognized inspection materials and tools, prepared materials and tools, and carried out inspection procedures properly and correctly.

2.3. Conducting magnetic test

This inspection technique is taught after participants were able to inspect with the visual method [10]. They were taught about the inspection using magnetic test, recognizing inspection materials and tools, preparing materials and tools, and carrying out inspection procedures properly and correctly. At last, they needed to carry out the measurement process after the initial process that determined the inspection results.

2.4. Ultrasonic testing

This procedure was taught after participants learned about the ultrasonic test method [11]. Training participants were taught about theories of inspection using magnetic test, recognizing

inspection materials and tools, preparing materials and tools, and carrying out inspection procedures according to applicable standards.

3. Results and Discussion

3.1. Results

This community service activity was carried out well and smoothly on June 10-13, 2024. The training and mentoring activities were carried out at the Wates Campus, Faculty of Vocational Studies, UNY. As many as15 teachers coming from the Kulon Progo Regency area participated in this community service. The results of this activity are:

a. Participants understood the material on the method of inspection and testing of non-destructive welding results (NDT).
b. Participants have skills in carrying out inspection and testing of non-destructive welding results.
c. Participants have the awareness to always apply the principles of the right inspection method in every welding test.

3.2. Discussion

This training and mentoring activity is specifically designed to improve teacher competency in the field of welding testing using non-destructive methods (Non-Destructive Testing/NDT). With the increasingly urgent need to provide technology-based education and industry standards, this training is divided into two main parts: training and practical mentoring. The main objective of both activities are for teachers to master welding testing techniques with industry standards, which can later be applied in the learning process at school, and prepared to produce graduates who are better prepared to face the challenges of the world of work.

At the training stage, participants were taught four main NDT methods, namely visual testing, testing with penetrant fluid, magnetic test, and ultrasonic test. Each method presentation began with an in-depth theoretical explanation, where participants were given basic knowledge about the concepts, tools, and procedures used in these testing techniques. The process is presented in Figure 1 below.

Fig. 1. Presentation about NDT Theory

Visual testing was the first method taught because this method functions as a basic step in identifying welding defects that can be seen directly [12]. The participants were required to hone their observation skills, learn the causes of welding defects, and improve technical analysis skills that will be useful in teaching welding techniques to students. By mastering this visual testing, training participants could understand the pre-, during, and post-welding processes better.

In the next stage, the training continues with the introduction of more complex testing methods through penetrant fluid and magnetic tests. These two methods provide participants with deeper insight into identifying welding defects that are below the metal surface, which cannot be detected by visual testing alone [13]. In this session, participants were taught to use more sophisticated tools and carry out testing procedures in accordance with industry standards currently being promoted. In addition, they also learned how to make accurate measurements to determine the quality of the weld being tested. Mastery of this method not only improved participants' knowledge but also technical skills in operating the tools and materials needed in the testing process. Later on, these skills can be used to teach more comprehensively at vocational high schools [14].

Furthermore, the ultrasonic test method was introduced as a sophisticated technology that can detect deeper welding defects without damaging the material [15]. Ultrasonic testing is very relevant to the development of technology in the industrial world today, so participants showed a high interest in mastering this method [16]. Through this training, participants not only understood the basic concepts of ultrasonic technology but were also trained to use related tools efficiently and appropriately. After all, this training aimed to introduce cutting-edge technology, which teacher can used to teach students as part of modern engineering education that is relevant to today's industrial needs.

Assisted practice conducted after theoretical training provided an opportunity for participants to apply the knowledge and skills they have learned in real conditions [17]. In this assistance stage, participants received direct guidance in using NDT tools in the field, with situations and conditions that resembled real industry. This assistance is important to ensure that participants not only understand the testing theory, but are also able to apply testing procedures independently and accurately in the field. The results of this assistance activity show that participants were able to conduct inspections using the methods taught properly and correctly, which increased their confidence in applying welding testing techniques in the real world. The assisted practice process is presented in Figure 2.

Fig. 2. Assisted Practice

Overall, this training and mentoring activity successfully achieved its goal of improving teacher competency in non-destructive welding testing techniques. This improvement is shown by the increasing understanding, skills, and analytical abilities of participants in each stage of the training. Teachers who participated in this activity are then expected to be able to pass on the knowledge and skills they have acquired to students in schools. Therefore, graduates of the welding engineering

education program will have better competency and be ready to compete in the ever-growing world of work, especially in the industrial sector that is increasingly dependent on modern technology.

4. Conclusions

There are a number of important takeaways from the community work that was carried out. First, there was a clear demand for this kind of technical expertise in the community, since 15 people signed up for the training program. Individuals eager to improve their abilities in welding inspection and testing made up the participants, therefore this figure shows the future reach and influence of programs like this. Secondly, prior to the instruction, the participants' abilities were rather low. This discovery reveals that they are lacking in expertise, especially when it comes to welding inspection methods and Non-Destructive Testing (NDT). The need of offering accessible and effective training opportunities to fill this knowledge gap was highlighted by the fact that most participants were unfamiliar with the basic ideas and practical applications of NDT procedures. Thirdly, this demand was adequately met by the training. At the conclusion of the training, every single participant had a thorough grasp of the subject matter. The participants' enthusiasm for learning and putting what they've learned into practice, along with the high standard of the training, are the driving forces behind this outstanding result. Lastly, the participants really nailed it when it came to welding testing, both theoretically and practically. This necessitates an in-depth familiarity with a wide range of testing procedures, including but not limited to optical, penetrant, magnetic, and ultrasonic examinations. These developments have not only improved their technical competences, but also given them the tools they need to guarantee the integrity and security of welded constructions. The training program was a success because it provided participants with knowledge and skills that will help them in their careers and in the community at large.

Conflict of interest

The authors declare no conflict of interest.

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Family Financial Management Training as an Effort to Create Healthy and Prosperous Families in Karangsari, Pengasih, Kulon Progo

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ABSTRACT

This training program aimed to improve family financial literacy as part of a strategy to strengthen family resilience, improve welfare, and reduce the risk of poverty. The training was initiated because of the lack of skills in managing family finances. Two activities were conducted during the training, namely classical classes and workshops. In classical classes, the spokesperson provided an explanation of the material, while the workshop was about financial planning and management practice. This training was held at the Karangsari Village Hall, Pengasih, Kulon Progo, with 30 participants from the Family Welfare Movement/Pemberdayaan dan Kesejahteraan Keluarga (PKK). The results of the training showed an increase in participant knowledge, as evidenced by an increase in scores from the pre-test to the post-test. The average pre-test score of participants was 57, while the average post-test score was 75, indicating an increase in their understanding of family financial management. The implication of this training is the importance of forming financial literacy cadres among PKK members to become agents of disseminating financial literacy in Karangsari Village.

1. Introduction

Karangsari is a village located in Pengasih District, Kulon Progo. It is close to the tourist area in Kulon Progo. Areas in the Regional Term Development Plan commonly have a poverty issue, as well as the low ability and skills of human resources in managing economic activities. One of these problems is related to family financial management. In managing their business finances, many people mixed them with family finances, thus hampering the performance of the business being run. The same thing also applies to family management [1].

Family finance is one of the most important aspects of everyday life. It includes the management of money and other financial resources to meet daily needs, deal with urgent needs, and plan for a financially stable future. Although it is a primary goal for many families, managing family finances is often a complex challenge which then causes problems that can affect the well-being and relationships within the family [2].

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Family financial management includes decision-making in the use and allocation of financial resources for family welfare. They highlight the importance of a basic understanding of investment and budgeting to achieve economic stability in the household [3]. Good financial planning at the family level can affect the overall quality of life of the family. Proper budget control helps in achieving short-term and long-term goals, such as children's education and retirement preparation [2]. A healthy household from an economic perspective can be divided based on conditions into 5 (five) levels from healthy to the healthiest conditions, namely: surplus income, savings, insurance, and investments.

Some of the common family financial problems include Lack of Financial Planning. Many families do not have a clear financial plan. This can lead to uncontrolled spending, difficulty in achieving financial goals, and financial uncertainty in the future. Second, Excessive Debt, one of the main problems faced by many families is being trapped in excessive debt. Credit card debt, personal loans, or electronic goods installments become a heavy burden on family finances, often exceeding the ability to pay them off [4]. Third, Lack of Emergency Funds, the absence of emergency savings can leave families vulnerable to unexpected financial situations, such as job loss or other urgent needs, which can disrupt the family's financial stability. Fourth, Lack of Financial Education, many families do not understand the basic concepts of finance, including money management, investment, and retirement planning. Lack of financial education can lead to inappropriate and detrimental financial decisions. Fifth, Family Conflict, financial problems are often a source of conflict within the family because differences of opinion about how to manage money, spending priorities, or financial responsibilities can cause tension and conflict among family members [5].

Understanding these issues, families can take steps to improve their financial management, minimize risks, and create better financial stability for their future. Seeing the importance of family financial literacy, the researchers held a community service program, in Karangsari Village by focusing on family financial literacy as a form of improving family welfare in Karangsari.

2. Method

The training was carried out systematically through three stages. The first stage is the pre-test stage. The aim was to determine the abilities of the participants before being given training treatment. Then the participants were given training in financial management. This session was divided into a session providing material and a session discussing cases faced in the village. After the material was presented, the participants completed a post-test aimed at measuring whether there was an increase in knowledge.

2.1. Family Financial Planning

Financial planning is a process that helps individuals and families achieve long-term financial goals, such as owning a home, saving for education, and planning for retirement. This process can be done on independently or with the help of a professional financial planner. There are two types of planning: comprehensive financial planning and planning for specific needs. This planning involves managing income and expenses and evaluating the impact of various financial decisions on the family's overall financial situation. In addition, careful planning helps families adjust to change and achieve financial security. The first step is to list all income and routine needs, followed by a list of non-routine needs in order of priority. The plan should be thoroughly evaluated before being implemented to ensure accuracy and identify potential savings. The results of the evaluation are then recorded for reference in implementation [6].

2.2. Implementation of Family Finance Management

There are several systems that can be applied to the financial planning implementation procedure, namely:

a. Envelope System: Money is grouped into envelopes according to the category of needs.
b. Cash Book System: Recording is done in a special book that groups expenses.
c. Family Cash System: Expenses are divided into fixed, daily, and unexpected categories.
d. Daily Cash System: Requires careful recording of daily expenses, which is suitable for those who consistently record.

2.3. Family Financial Monitoring

Monitoring is carried out to assess the effectiveness of the financial plan that has been implemented and to assist in future improvements. The assessment includes five main criteria: purpose, time, place, price, and quality, and is carried out regularly and systematically with the participation of all family members. Evaluation can be carried out as a whole or on each part of expenditure to find out which parts need to be improved or reallocated in the following month.

3. Results and Discussion

3.1. Results

The training was held at the Karangsari village hall, Pengasih, Kulon Progo on August 2-3 at 08:00-10:30 a.m. The participants were thirty PKK members from Karangsari village. The training was carried out in two stages. The first stage was the delivery of material on the importance of priority scales in family financial management.

Furthermore, participants were taught about the importance of maintaining a balance between income and expenses. The next material was the importance of planning family expenses. On the first day, thirty PKK members participated. In general, this community service activity went smoothly. In the second stage which was done on day 2, the training focused on recording income and expenses to improve family financial management skills. At the end, the committee gave a post-test as evaluation material.

Overall, the training received a good response and seemed to be beneficial for the participants. Participants listened to the explanation process well. Then the participants also actively participated in the discussion. This is evidenced by the comparison between the results of the pre-test and post-test. On average, participants got a score of 57 for the pre-test results. Then, the participants got an average score of 75 in the post-test. This means that the training activity was successful because there was an increase in knowledge.

3.2. Discussion

This community service activity ran well and smoothly because there were several supporting factors. However, it does not mean that there are no obstacles. Supporting factors for the implementation of the training activity were the cooperation among team members, dedication to Karangsari Village, the suitability of the material with the needs of the community and the high enthusiasm of the participants to understand the concept and importance of family financial management. Meanwhile, the inhibiting factors for the implementation are the limited number of participants invited so that knowledge and expertise cannot be felt by the entire Karangsari village community, the difference in age of participants and different backgrounds that lead to significant differences in understanding the material presented [7]. Therefore, different approaches in providing exposure are needed. The solution offered to solve this problem is, empowering a student team to help guide and assist when practicing archiving, the need to invite other cadres to take part in training, and creating smart financial literacy ambassadors in Karangsari Village.

However, some of the participants did not really understand how to manage family finance even though they participated almost every meeting. This means that strengthening archive cadres in PKK groups is important. A concrete step that can be taken is to form archive ambassadors in each RT group. The appointed ambassadors should be given the task of passing on archival knowledge to residents in their environment. The hope is that archives will become a culture in the family as the smallest community [8]. If archiving has become a culture, then managing archives will also be easier. Furthermore, if the community is accustomed to archiving documents manually or digitally, then community participation in public services, especially digital-based ones, will automatically increase. The reason is that the community is already familiar with digital family document archives.

4. Conclusions

Based on the results and discussion above, it can be concluded that the training activities organized by the UNY Community Service Team were successful. This is proven by the comparison between the results of the pre-test and post-test. On average, participants got a score of 57 for the pre-test, and 75 for the posttest. This means that the training activities can be concluded as successful because there was an increase in knowledge from participants who took part in the training for two days. Then, based on the activities carried out, the team conducted an evaluation so that in the future, community service activities would be better, such as by increasing the ability of archive cadres by monitoring periodically. Then, it is suggested that important knowledge transfer should carried out to cadres who are younger. The main cadres (who participated in the training) were mostly elderly and became the next community service recommendation with the training topics "digitalization of archiving information systems" and "PKK archiving management".

Conflict of interest

The authors declare no conflict of interest.

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Performance Assessment and Actual Operational Maintenance Needs (AKNOP) of Situ Ranca Gede Kawao, Serang Regency

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ABSTRACT

The increasing population in Indonesia demands sufficient food availability to achieve national food security. Food security is a strategic policy involving social, economic, cultural, environmental, and political aspects, with its success indicators determined by adequate food access. Addressing food security issues requires factors such as infrastructure, sustainable technology, and land availability. Effective agricultural land management, supported by water resources, is crucial for improving agricultural productivity. Situ (water reservoirs) play a significant role in supporting agricultural productivity, particularly in Serang Regency, and make a notable contribution to rice production. Ensuring proper management of the situ through technical evaluation and maintenance audits is essential to enhance operational efficiency and support food security goals. Performance assessment and AKNOP preparation are critical for identifying areas of improvement and optimal resource allocation. This activity aims to provide information on components that require attention and serves as a guideline for budget preparation. The performance assessment indicated that Situ Ranca Gede Kawao received a score of 57.17, categorized as sufficient. Components that need improvement include operational guidelines, supporting documents, staff competency, and community involvement. Field identification revealed minor damages that impact water retention, requiring attention to ensure optimal functionality. The results of the AKNOP preparation for Situ Ranca Gede Kawao include operational and maintenance costs totaling IDR 250,905,325. Technical audits, including operational and maintenance cost calculations, provide a foundation for targeted actions to improve the situ's performance and maintain agricultural productivity. A proactive management strategy is key to ensuring the operational efficiency and maintenance of Situ Ranca Gede Kawao, thereby contributing to national food security efforts.

1. Introduction

The population of Indonesia tends to increase annually, with an average growth rate of 1.16% per year [1]. This population growth must be accompanied by adequate food availability to achieve national food security. Security itself is a system that aims to maintain structure from disruptions. The actors in the planting system include farmers, processing, distribution processes, consumers, the types of food required, and the components of the food chain. Food security is a strategic policy formulated by the government to meet food needs. Food security comprises several important

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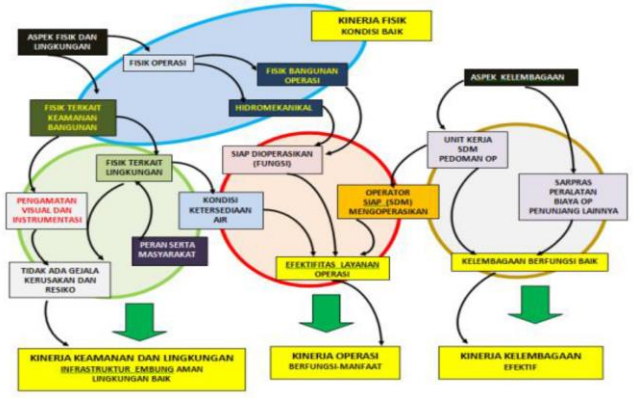
aspects, including social, economic, cultural, environmental, and political dimensions [2]. The success indicator of food security is when access to food needs is adequately met [3]. Addressing food security challenges involves various factors, such as existing infrastructure, renewable technology, and land availability.

Appropriate availability of agricultural land can increase agricultural productivity. In this context, the integration of land availability, human resources, and supporting technology is crucial for realizing food security. Optimizing existing agricultural land must be supported by sufficient water resources. Adequate water supply for existing agricultural land can enhance agricultural productivity, necessitating efforts to preserve water resources. One of the government's initiatives to maintain water resource sustainability is the construction of water storage structures such as reservoirs, situ, or ponds. Situ are depressions used to store water sourced from rainfall, rivers, and springs. The utilization of situ includes raw water supply, clean water, agricultural irrigation, and other needs. However, situ can pose risks if proper maintenance efforts are not conducted [4]. Such neglect can be hazardous for agricultural land or downstream settlements. The role of situ is critical in realizing food security by ensuring sufficient water availability, which in turn increases agricultural productivity.

Situ are widely distributed in the western part of Java Island. The province of Banten has approximately 53 situ, consisting of 45 managed by the central authority under the Cidanau Ciujung Cidurian River Basin Authority and 8 managed by the Public Works and Housing Agency (PUPR) of Banten Province. Most of the situ in Banten Province are utilized for irrigation. Serang Regency has 20 situ under the Cidanau Ciujung Cidurian River Basin Authority, or approximately 37% of the total situ in Banten Province. These situ structures support the efforts of the Serang Regency Government to become one of the rice barns in Banten Province, contributing to maintaining the stability of national food security. According to [1], in 2023, rice production in Banten Province reached 1.68 million tons, with 27% contributed by Serang Regency.

Situ Ranca Gede Kawao is one of the situ with a storage capacity of 11,500 m^3 and an irrigation service area of 200 hectares. Besides serving agricultural needs, the situ also supplies raw water for local communities. However, the primary issue faced by Situ Ranca Gede Kawao is the inadequate provision of clean water services. This is due to the suboptimal routine and periodic maintenance, with the last maintenance carried out in 2019. Therefore, a technical study and audit of the situ structure, which has experienced functional decline, as well as repair activities, are necessary [5].



KINERJA FISIK KONDISI BAIK **Physical Performance in Good Condition**	SUMBER DAYA MANUSIA TERSEDIA **Available Human Resources**
ASPEK FISIK DAN LINGKUNGAN **Physical and Environmental Aspects**	SUMBER DAYA MANUSIA TERSIAPKAN **Prepared Human Resources**
ASPEK KELEMBAGAAN **Institutional Aspects**	PERAN SERTA MASYARAKAT **Community Participation**
FISIK OPERASI **Operational Physical Conditions**	SOP DIOPERASIKAN **Standard Operating Procedures (SOP) are Operated**
FISIK TERKAIT KEAMANAN DAN LINGKUNGAN **Physical Aspects Related to Safety and Environment**	KOORDINASI KETERSEDIAAN AIR **Water Availability Coordination**
PERMASALAHAN VISUAL INFRASTRUKTUR **Visual Issues in Infrastructure**	EFEKTIFITAS LAYANAN OPERASI **Effectiveness of Operational Services**
FISIK BANGUNAN OPERASIONAL **Operational Building Conditions**	OPERATOR (SDM) MENGOPERASIKAN **Operators (Human Resources) Operate**
HIDROMEKANIKAL **Hydromechanical**	UNIT KERJA SESUAI PEDOMAN OP **Work Units in Accordance with Operational Guidelines**
TIDAK ADA GEJALA KERUSAKAN AIR DAN TANAH **No Signs of Water and Soil Damage**	SAMPAH (RECYCLE) PENANGANAN, DRAINASE, DAN PENUMBUHAN LAPISNYA **Waste (Recycling) Management, Drainage, and Layer Regeneration**
KINERJA OPERASI BERFUNGSI MAKSIMAL **Operational Performance Functioning Maximally**	KINERJA KELEMBAGAAN BERFUNGSI BAIK **Institutional Performance Functioning Well**
KINERJA KELEMBAGAAN EFEKTIF **Effective Institutional Performance**	

Fig. 1. Conceptual Framework for Situ/Pond Performance Analysis

A technical audit or performance assessment is conducted to determine the condition and functionality of the situ. The Actual Operational and Maintenance Needs (AKNOP) is an activity involving the planning of routine and periodic maintenance based on the current condition of the infrastructure, with its output serving as a reference for funding future operation and maintenance activities [6]. According to [7], there are four aspects evaluated in the performance assessment of situ: physical condition assessment, operational and service assessment, structural and

environmental safety assessment, and institutional quality assessment. All these aspects are interconnected.

Each performance assessment aspect has sub-aspects with predetermined weightings. A more detailed explanation is provided in Table 1 below.

Table 1. Situ Performance Assessment Aspects and Weightings

Assessment Aspect	Sub-Assessment Aspect	Weight (%)
Physical Performance	1. Main Structure	40
	2. Spillway Structure	15
	3. Water Intake Structure	25
	4. Supporting Structures	10
Operational and Service Performance	1. Operations	60
	2. Services	40
Safety and Environmental Performance	1. Structural Safety	50
	2. Environment	50
Institutional Performance	1. Management	25
	2. Human Resources	25
	3. Operational Guidelines (OP) Documents	25
	4. Facilities and Infrastructure for OP	25

Table 2. Performance Scores and Categories for Situ Operations and Maintenance

Score	Performance Category
80 – 100	Good Performance
55 - < 80	Sufficient Performance
<55	Poor Performance

The Actual Operational and Maintenance Needs (AKNOP) are calculated based on damage data reviewed directly in the field. The AKNOP data is obtained by summing up the product of volume, frequency, and unit price of work for each operational activity, routine maintenance, and periodic maintenance. The AKNOP calculation is formulated as follows:

$$AKNOP = \Sigma\ V\ x\ F\ x\ HSP \quad (1)$$

Note:

V = Volume of Situ operation and maintenance activities
F = Frequency of activities
HSP = Unit price of work

2. Method

2.1. Research Location

This research was conducted at Situ Ranca Gede Kawao, located in Binuang District, Serang Regency. The location of Situ Ranca Gede Kawao can be seen in Figure 2 below.

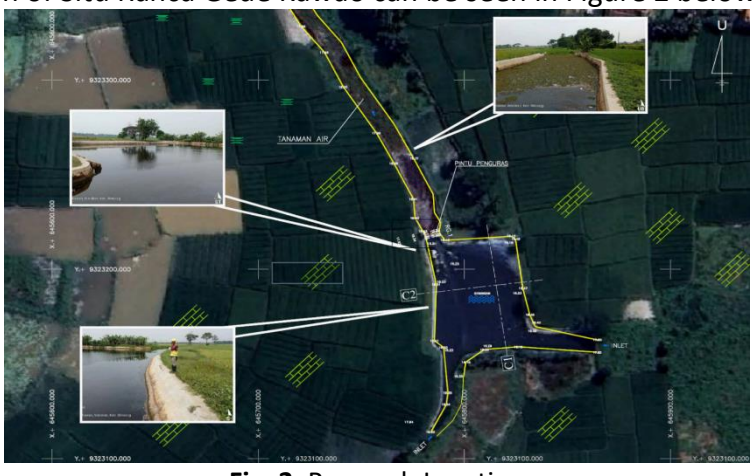


Fig. 2. Research Location

2.2. Implementation Procedure

The implementation of the Performance Assessment and the Preparation of the Actual Operational and Maintenance Needs (AKNOP) includes preparation activities, data inventory, situ performance assessment, calculations, and the preparation of AKNOP.

2.3. Data Collection Technique

Data for the Performance Assessment and Preparation of AKNOP were obtained through two methods: primary data and secondary data. Primary data were collected through field observations, including direct observation and interviews with situ personnel. Secondary data were gathered from previous reports, situ operation and maintenance (OP) manuals, drawings, and supporting documents.

2.4. Data Inventory and Performance Assessment

The activities began with the collection of secondary data, followed by field visits to gather the required information. The inventoried data were then rechecked in the field through direct observation and assessed using pre-determined forms. Field observation activities were accompanied by measurements of structural damages in the situ, which serve as the basis for the preparation of AKNOP.

2.5. Preparation of AKNOP

The Actual Operational and Maintenance Needs (AKNOP) were derived from the damage findings observed in the field. The follow-up to the preparation of AKNOP includes costs for routine operations, routine maintenance, and periodic maintenance. Routine operations cover: situ operation personnel, field equipment, and documents and reports. Routine maintenance activities include grass cutting, dense weed removal, dry weed cleaning, painting, and gate lubrication. Periodic maintenance is determined based on the direct damage findings from the field observations.

2.6. Determination of Priority Scale for Actions

The results of the performance assessment and the AKNOP preparation are used to determine a priority scale as a reference for operations and maintenance in the following year. Factors influencing the priority scale include the level of need and the availability of supporting facilities and infrastructure.

3. Results and Discussion

3.1. Results

3.1.1. Performance Assessment of Situ Ranca Gede Kawao

The performance assessment of Situ Ranca Gede Kawao was conducted through observations of both physical and non-physical aspects of the situ. The results of the physical performance assessment are presented in Table 3.

Table 3. Physical Performance Assessment of Situ Ranca Gede Kawao

Component	Weight (%)	Component Score	Physical Performance Score
Main Structure	40	69.00	62.66
Spillway Structure	25	72.00	
Intake Structure	25	39.68	
Complementary Structures	10	71.40	

Based on Table 4, it shows that, in general, the physical performance of Situ Ranca Gede Kawao is in a fairly good condition. Field observations indicate that the infrastructure of the structures is still functioning well but requires repairs, particularly the spillway structure, which has minor cracks, and the intake structure, which has silt buildup and needs restoration. Components in good

condition need regular maintenance to ensure the reliability of the structures. The performance assessment further includes non-physical performance related to operations, services, safety, and environmental quality. The performance assessment results for Situ Ranca Gede Kawao are shown in Tables 3–5 below.

Table 4. Performance Assessment of Operations and Services at Situ Ranca Gede Kawao

Component	Weight (%)	Component Score	Operations and Services Score
Situ Operations	50	36.00	40.50
Situ Services	50	45.00	

Based on Table 3, the operations and services performance of Situ Ranca Gede Kawao is in poor condition. This is caused by a lack of situ operational guidelines/manuals and a limited number of staff. These factors hinder the operations and services performance, such as insufficient water availability to meet community needs. In addition, water quality and distribution from Situ Ranca Gede Kawao are not yet optimal. Excessive sedimentation in the situ base and outlet channels also negatively impacts irrigation flow. A more comprehensive and detailed operational manual is required to resolve this issue.

Table 5. Performance Assessment of Situ Structure Safety and Environment at Situ Ranca Gede Kawao

Component	Weight (%)	Component Score	Safety and Environmental Score
Structure Safety	60	65.80	71.30
Environment Quality	40	79.55	

Based on Table 4, the safety performance of the structure and the environmental condition of Situ Ranca Gede Kawao are in fairly good condition. Observations and field inspections indicate that the structural safety is in good condition, and visually, there are no issues that disrupt the performance of the situ. Structural safety is also supported by routine reports from personnel, which are conducted every six months. Several aspects need to be improved to enhance the safety of the situ, such as installing monitoring instruments like CCTV. The environmental aspect of the situ performance assessment also shows fairly good results. Field observations indicate that the surrounding area, such as buffer zones and water inundation areas, are still well maintained. However, community participation in maintaining the situ needs to be improved. So far, the maintenance of the situ has been mainly focused on the situ operational personnel. Agricultural activities around the situ also need to be controlled as they can cause sedimentation. There is a need for socialization regarding proper planting methods and types of crops that can reduce the rate of sedimentation in this area.

Tabel 6. Performance Assessment of Institutional Aspects of Situ Ranca Gede Kawao

Component	Weight (%)	Component Score	Institutional Performance Score
Situ Manager	25	100.00	58.75
Human Resources	25	50.00	
Operational Document	25	24.00	
Infrastructure	25	61.00	

Based on Table 5, it shows that the institutional performance of Situ Ranca Gede Kawao is in poor condition. The limited number of personnel has become an issue, and the management structure is not yet established, which is one of the causes of the poor institutional performance at Situ Ranca Gede Kawao. The lack of supporting infrastructure such as office facilities, operational vehicles, and necessary documents has not been fulfilled. The observations indicate that the available infrastructure does not meet the guidelines for institutional performance assessment. From the data in the table, it can be concluded that the performance of Situ Ranca Gede Kawao falls into the "adequate" category. Several supporting aspects, such as the provision of supporting documents and infrastructure, must be completed to enhance its performance. A recap of Situ Ranca Gede Kawao's performance assessment can be seen in Table 6 and Figure 3.

Table 7. Recapitulation of Situ Ranca Gede Kawao Performance Assessment

Assessment Item	Optimal Weight (%)	Maximum Weight (%)	Final Weight (%)
Physical Performance	20.13	35.00	21.93
Operations and Services	17.25	30.00	12.15
Safety and Environment	11.50	20.00	14.26
Institutional Performance	8.63	15.00	8.81
Total		57.15	Adequate Performance

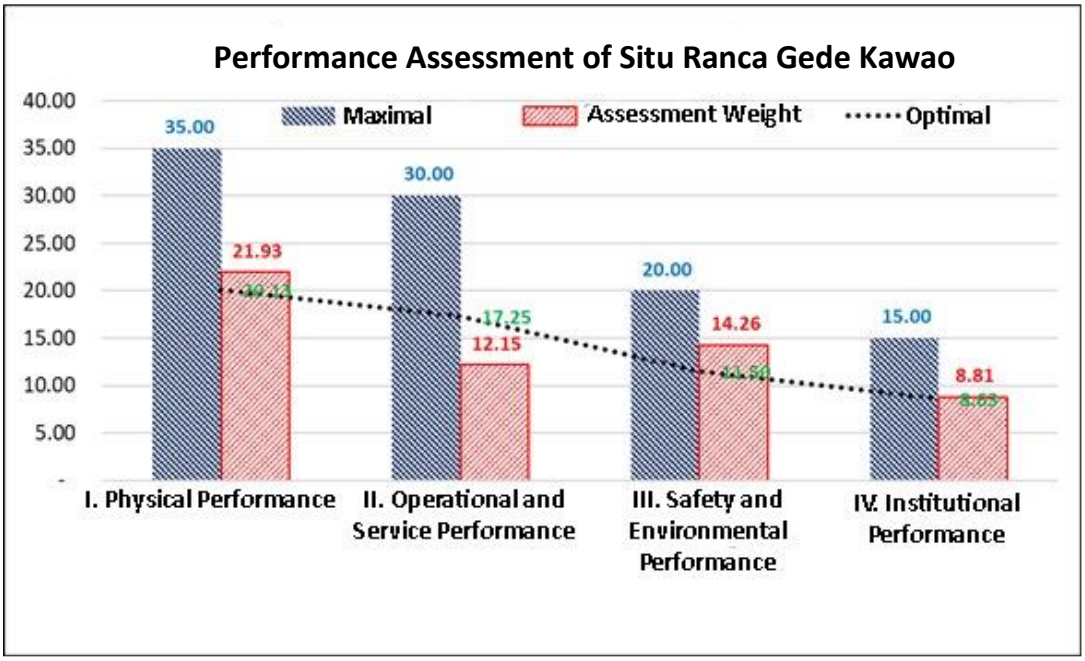


Fig. 3. Recapitulation of Situ Ranca Gede Kawao Performance Assessment

3.1.2. Preparation of Actual Performance Figures for Operation and Maintenance

The Actual Performance Figures for Operation and Maintenance (AKNOP) are prepared based on the identification of damages observed in the field. The AKNOP for the reservoir is compiled to determine the budget allocation for operation and maintenance activities for the following fiscal year. The purpose of preparing the AKNOP is to ensure that the allocated budget is targeted accurately according to existing needs while guaranteeing transparency, efficiency, effectiveness, and accountability. The preparation of the Actual Performance Figures for Operation and Maintenance (AKNOP) for Situ Ranca Gede Kawao consists of three components, which include: Routine operations, Routine maintenance, and Periodic maintenance. The costs for routine operations at Situ Ranca Gede Kawao are presented in Table 6.

Table 8. Operation Costs of Ranca Gede Kawao for Fiscal Year 2025

Component	Amount (Rp)
Documentation and Reporting	5,341,350
Operations	78,000,000
Field Equipment	1,620,000
Total Cost	84,961,350

The planned operation costs are based on the results of the field needs identification. The procurement of field equipment such as boots, helmets, vests, masks, and other necessary items has also been carried out. This is intended to support the performance of the Situ OP staff. Other AKNOP aspects, such as routine maintenance and periodic maintenance, are based on the results of field identification and damage measurements. The routine maintenance costs are calculated based on field identification. The majority of the routine maintenance at Situ Ranca Gede Kawao involves

weed cleaning. The components and costs of routine maintenance are presented in Table 7 and Figures 4-5.

Table 9. Routine Maintenance Costs of Situ Ranca Gede Kawao

Component	Unit	Volume	Unit Price (Rp)	Total Cost (Rp)
Tree Cutting (Clearing)	m^2	1002	9,853	9,872,706
Grass Cutting	m^2	253	883	223,457
Solid Weed Cleaning	m^3	315	98,530	31,036,950
Painting	m^2	13.50	59,253	799,924
Door Lubrication	Unit	12	26,156	313,880
			Total Cost	42,246,918

Source: SHBJ Provinsi Banten 2024, SE Bina Konstruksi 2023

Fig. 4. Location of Routine Maintenance for Tree Cutting and Grass Cutting

Fig. 5. Solid Weed Cleaning

In general, the physical infrastructure of Situ Ranca Gede Kawao is in good condition. Sedimentation remains the primary issue for the site. Minor damages also occurred to the situ lining over a 100-meter stretch (Figure 6) and the washing staircase over 3 meters (Figure 7). The damage to the lining has caused leaks, resulting in reduced water supply for agricultural land. The periodic maintenance costs have been prioritized for the repair of the situ lining, as this is a critical component of the site.

Fig. 6. Damage to Situ Lining

Fig. 7. Damage to Washing Staircase

3.2. Discussion

Food security is a major challenge for Indonesia in maintaining the stability of agricultural production. A good agricultural system supported by enabling technology can meet the desired productivity levels [8]. Water availability is crucial for supporting the success of increasing agricultural productivity. Water and food security are two major challenges faced by the world. One of the connections between the two is agricultural irrigation, with more than 70% of total water being used for agriculture or food production [9]. Therefore, it is important to maintain the sustainability of water sources. The government has made efforts to preserve water sources by

building water reservoirs such as lakes (situ). Situ also plays a role in sustaining rural life by providing water through proper management via operation and maintenance regulation [10].

As one of the rice granaries in Banten Province, Serang Regency continues to optimize water resources such as situ. Situ Ranca Gede Kawao is one of the lakes in Serang Regency relied upon to support agricultural productivity. In this regard, the government under the authority of the Cidanau Ciujung Cidurian River Basin Organization has conducted a technical audit in the form of Performance Assessment and the preparation of AKNOP (Real Operational and Maintenance Performance Number), intended to assess the feasibility of Situ Ranca Gede Kawao's function. This activity aims to ensure that Situ Ranca Gede Kawao can function optimally. The performance assessment shows that the physical and non-physical condition of Situ Ranca Gede Kawao is categorized as quite good, with a score of 57.17, as detailed in Tables 2 to 5. Problems at Situ Ranca Gede Kawao include significant sedimentation and aquatic weeds, which reduce the reservoir volume. If the sedimentation rate exceeds the plan, the lake's operational performance will decline, and the water volume will decrease, making operations ineffective [11]. Changes in volume need to be evaluated to assess the lake's ability to meet water needs [12]. Uncontrolled weed growth is another issue that must be addressed immediately. Weeds can result in water loss from the reservoir. Evapotranspiration from the weeds reduces the lake's water level and causes sedimentation [13]. Another factor affecting the performance of Situ Ranca Gede Kawao is non-physical factors such as operational manuals, supporting documents (as-built drawings, operational history documents, planning documents), staff competence, and community involvement. Based on the performance assessment, the number and competence of staff are not well-implemented. The absence of an institutional management structure for the lake could lead to a decline in the lake's function. The current staff at Situ Ranca Gede Kawao often have multiple roles, as there is no clear division of tasks and functions. There is a need for an increase in the number of staff and capacity building through technical guidance. According to research [14], the better the quality of human resources, the higher the institutional performance, thus improving the operation and maintenance of infrastructure. Successful management is determined by the integration of physical and non-physical performance, ensuring reliable water resource provision [15].

The calculation of the Real Operational and Maintenance Performance Number (AKNOP) is carried out based on field identification and measurements. The AKNOP budget consists of routine operations, routine maintenance, and periodic maintenance. The calculations show that the maintenance priorities at Situ Ranca Gede Kawao are sediment excavation and weed cleaning. These activities are essential to maintain the water storage volume so it can support surface irrigation in the Binuang District, Serang Regency. Minor damage such as cracks in the walls is also considered in the preparation of AKNOP for the 2025 budget. Small repairs are made to prevent larger damages. Preparing the operational costs for the OP staff is equally important, as these staff members are crucial for conducting the operations and maintenance of Situ Ranca Gede Kawao. The operational costs include not only staff salaries but also equipment and documents that support their tasks.

The results of the Performance Assessment and the calculation of the Real Operational and Maintenance Performance Number (AKNOP) provide a foundation or recommendation for the relevant authorities to take appropriate actions so that Situ Ranca Gede Kawao can contribute to the success of Serang Regency as the rice granary of Banten Province in ensuring national food security stability.

4. Conclusions

Based on the results of the Performance Assessment and the calculation of the Real Operational and Maintenance Performance Number (AKNOP), it is evident that the operation and maintenance

activities of the situ structure are crucial for the continuity of Situ Ranca Gede Kawao's service functions. The performance assessment serves as the first step in providing information on which components need improvement and enhancement, so future efforts to improve the lake's performance will be more efficient and effective. The calculated operation and maintenance costs will serve as a basis for the 2025 budget preparation, ensuring that damages at Situ Ranca Gede Kawao are promptly addressed. The recapitalized AKNOP cost for Situ Ranca Gede Kawao is Rp 250,905,325, with a performance assessment in the "adequate" category.

Conflict of interest

The authors declare no conflict of interest.

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