

Nurturing Roses and Urban Dreams by Utilizing Village Budgets for Sustainable Growth in Karangpring and Jubung

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Abstract

This study aims to analyze the allocation of village funds for sustainable development and calculate the carbon footprint associated with village activities. Using a qualitative case study approach, data were collected through in-depth interviews with village heads and analysis of the 2023 Village Budget (APBDes) documents. The findings show that both villages allocate a significant portion of their budgets to infrastructure, community services, and social security. However, not all budget allocations directly contribute to measurable carbon emissions, only certain items such as raw materials, IT tools, and vehicles. This study contributes to the understanding of how effective budget allocation and sustainable practices can reduce carbon footprints and promote the importance of implementing sustainable development at the village level. Both villages in the study can significantly improve sustainable development efforts by focusing on providing environmentally friendly materials, improving energy efficiency, and involving community participation in planning. These findings can be a model for other villages in Indonesia that want to achieve sustainable development.

Keywords: Sustainable Development; Village Budget Management; Carbon Footprint; Village Innovation

Abstrak

Penelitian ini bertujuan untuk menganalisis alokasi dana desa terhadap pembangunan berkelanjutan dan menghitung jejak karbon yang terkait dengan aktivitas desa. Dengan menggunakan pendekatan studi kasus kualitatif, data dikumpulkan melalui wawancara mendalam dengan kepala desa dan analisis dokumen APBDes 2023. Temuan menunjukkan bahwa kedua desa mengalokasikan bagian signifikan dari anggaran mereka untuk infrastruktur, layanan masyarakat, dan jaminan sosial. Namun, tidak semua alokasi anggaran langsung berkontribusi pada emisi karbon yang dapat diukur, hanya item tertentu seperti bahan baku, alat TI, dan kendaraan. Penelitian ini berkontribusi pada pemahaman tentang bagaimana alokasi anggaran yang efektif dan praktik berkelanjutan dapat mengurangi jejak karbon dan mempromosikan pentingnya implementasi pembangunan berkelanjutan di tingkat desa. Kedua Desa dalam penelitian dapat secara signifikan meningkatkan upaya pembangunan berkelanjutan melalui fokus pada penyediaan bahan ramah lingkungan, meningkatkan efisiensi energi, dan melibatkan partisipasi masyarakat

dalam perencanaan. Temuan ini dapat menjadi model bagi desa-desa lain di Indonesia yang ingin mencapai pembangunan berkelanjutan.

Kata Kunci: Pembangunan Berkelanjutan; Pengelolaan APBDes; Jejak Karbon; Inovasi Desa

1. INTRODUCTION

Although the concept of sustainability was introduced over 37 years ago, the current state of the world does not show significant improvement (Luo et al., 2023). In fact, the term “Global Warming” has evolved into “Global Boiling”, describing the extreme rise in global temperatures being experienced (Jehn et al., 2022; Richardson et al., 2023). This indicates that efforts to implement sustainable practices have not been effective enough to counteract the negative impacts of climate change and environmental degradation (Stroebe & Wurgler, 2021). The inability to control greenhouse gas emissions and environmental degradation continues to worsen the condition of the Earth, threatening the lives and well-being of future generations.

This situation has led to the application of sustainability principles not only by higher administrative entities but also by villages that often rely on natural resources for their livelihoods (Delgado-Ceballos et al., 2023). By adopting sustainable practices, villages can ensure that natural resources remain available and productive for future generations. This concept also encompasses the development of environmentally friendly local economies, sustainable education, and efficient and responsible resource management. Implementing sustainability at the village level helps create resilient and self-reliant communities capable of adapting to future changes and challenges.

Sustainable village development is key to improving community welfare and promoting equitable development (Herman, 2024). Oktaviani & Pratiwi, (2024) mentioned that effective management of village fund budgets is crucial for achieving sustainable development at the village level. A sustainable village development approach allows villages to utilize these funds for initiatives that support sustainability. Villages with higher expenditures in categories supporting sustainability, such as infrastructure, education, and environmentally friendly initiatives, show a quicker likelihood of achieving sustainability goals. Meanwhile, villages with lower expenditures might face greater challenges or have other priorities that could hinder their focus on sustainability.

According to 2023 RAPBDes data, Jubung and Karangpring villages have village funds below the average amount of other villages. However, both villages are classified as self-sufficient. Jubung Village, located in Sukorambi District, Jember Regency, is strategically situated near the gateway to Jember City. Jubung Village has shown significant financial performance through its BUMDES operations, achieving the status of a Self-Sufficient Village in 2021. On the other hand, Karangpring Village, located at the foot of Mount Argopuro, Sukorambi District, Jember Regency, also has great potential to become a tourist village. Research conducted in 2023 shows that Karangpring Village has abundant natural

resources, such as coffee plantations and rose gardens, supporting the village's economic growth. This demonstrates that despite the limited village funds, Jubung and Karangpring Villages can manage their resources to become Self-Sufficient Villages.

However, behind this great potential, there are still various challenges to face. These challenges include limited infrastructure, inadequate accessibility, and human resource issues, which are the main obstacles to sustainable village development. Therefore, innovation and appropriate strategies are needed to overcome these obstacles and maximize existing potential.

Considering the importance of implementing sustainable development, this article aims to delve deeper into the innovations applied and the challenges faced by Jubung and Karangpring Villages in their efforts to achieve sustainable village development. Furthermore, this study also aims to explore the calculation of the carbon footprint to provide a more comprehensive picture of the environmental impact of village activities and to design more effective strategies to reduce carbon emissions and promote environmentally friendly practices. It is hoped that effective solutions can be found and applied to other villages in Indonesia to support equitable development and improve village community welfare.

2. LITERATURE REVIEW

Sustainable Village Concept

The concept of a sustainable village is a development approach aimed at improving the quality of life in rural communities by balancing social, economic, and environmental aspects (Adamowicz & Zwolinska-Ligaj, 2020; Del Arco et al., 2021). This concept emphasizes the wise use of natural resources, the application of eco-friendly technology, and innovations supporting the green economy (Zahoor et al., 2023). Sustainable villages focus not only on improving infrastructure and economic growth but also on ensuring that all community members have equitable access to resources and opportunities (Bisello et al., 2021).

The social aspect of sustainable villages includes investment in education and health to enhance the capacity and quality of life of the community (Del Arco et al., 2021; Tulla et al., 2020). The economic aspect involves diversifying income sources, such as sustainable agriculture, handicrafts, and ecotourism, which can reduce dependence on a single economic sector and increase the economic stability of the village (Gibson et al., 2023; Raja et al., 2022). The environmental aspect emphasizes the preservation of natural resources through practices like efficient water management, the use of renewable energy, and the conservation of soil and forests (Nugraha et al., 2022; Philokyprou & Michael, 2021; Winston, 2022).

This research aims to provide a comprehensive understanding of the environmental impact of village activities and design more effective strategies to reduce carbon emissions and promote environmentally friendly practices (Xu et al., 2024). Through this holistic approach, sustainable village development can help create resilient, self-reliant, and sustainable communities for current and future generations (Mehan & Mostafavi, 2022).

Village Revenue and Expenditure Budget Plan (RAPBDes)

The Village Revenue and Expenditure Budget Plan (RAPBDes) is a finance planning document prepared by the village government to manage the village's income and expenses for one fiscal year (Iznillah & Basri, 2019; Karim et al., 2021; Novita Sari et al., 2024). The RAPBDes serves as a vital instrument to ensure transparency, accountability, and community participation in the management of village resources (Gatto & Sadik-Zada, 2022; Schugurensky & Mook, 2024). It comprises two main parts: revenue and expenditure. Village revenue can come from various sources, including allocations from central and regional governments, village business income, donations, and grants from third parties (Kahar, 2023; Saputra et al., 2019).

In the preparation of the RAPBDes, the village deliberation process is crucial (Hussain et al., 2022; Sopanah et al., 2023). This deliberation involves various parties, including the village head, village officials, the Village Consultative Body (BPD), and local residents (Hendrawati et al., 2018; Kadir et al., 2021; Suhartono et al., 2020). The outcome of this deliberation is a list of development priorities reflecting the needs and aspirations of the community (Khashtabeh et al., 2019; Mardhia et al., 2021; Pebiona & Fiddin, 2023). A well-structured RAPBDes will reflect efficient and effective budget allocation for various programs and activities aimed at improving the welfare of the village community.

The expenditure part of the RAPBDes includes various spending items such as infrastructure development, public services, social programs, and economic activities. Capital expenditures for infrastructure development like roads, irrigation, and other public facilities often take priority due to their direct impact on improving the quality of life for residents (Nababan et al., 2020; Saepudin et al., 2022). Additionally, allocating funds for education (Psacharopoulos & Woodhall, 1993) and health is crucial for enhancing human resource capacity in the village.

Applying sustainability principles in managing the RAPBDes is also a key focus. Budget allocations supporting sustainability initiatives, such as renewable energy use, efficient water resource management, and environmentally friendly agricultural practices, can help villages achieve sustainable development goals. Thus, the RAPBDes not only functions as a financial management tool but also as an instrument to achieve inclusive and sustainable village development.

Carbon Footprint

A carbon footprint is the total measure of greenhouse gas (GHG) emissions produced by human activities, both directly and indirectly (He et al., 2022; Leichenko & O'Brien, 2024). These emissions are typically measured in tons of carbon dioxide equivalent (CO₂e) per year (IPCC). The carbon footprint encompasses various sources of emissions, such as the burning of fossil fuels for energy and transportation, industrial processes, and the use and disposal of products (Leichenko & O'Brien, 2024).

Understanding the carbon footprint is crucial because GHGs like carbon dioxide (CO₂) and methane (CH₄) significantly contribute to global warming and climate change. Calculating the carbon footprint helps individuals, companies, and governments understand the extent of their activities' environmental impact

(Karuppiah et al., 2020). This process involves identifying and measuring all emission sources in the supply chain and daily operations, from raw material production to final product distribution.

Reducing the carbon footprint can be achieved through various means, such as increasing energy efficiency, using renewable energy sources, reducing waste, and improving agricultural practices (Kahn et al., 2021). Additionally, carbon offset programs, like tree planting and investing in clean energy projects, can help offset unavoidable emissions (Wiedmann & Minx, 2007). Awareness and action to reduce the carbon footprint are essential for achieving global sustainability goals. By understanding and managing their carbon footprint, people can contribute to collective efforts to mitigate climate change and protect the planet for future generations (Chlebna et al., 2024; Dasgupta, 2024).

Case Studies

The Ministry of Villages, Development of Disadvantaged Regions, and Transmigration (Kemendes PDTT) has categorized nine types of villages aligned with the village SDGs, such as villages without poverty, health-conscious villages, environmentally-conscious villages, and others. Localizing the SDGs ensures that sustainable development can be established at the village level, which is expected to significantly contribute to achieving national development goals (Affandi et al., 2019; Ferrazzi, 2023). Based on this data, the table below will showcase concrete examples of villages in Indonesia that have successfully implemented sustainable development concepts.

Table 1. Successful Implementation of Sustainable Development Concepts in Villages in Indonesia

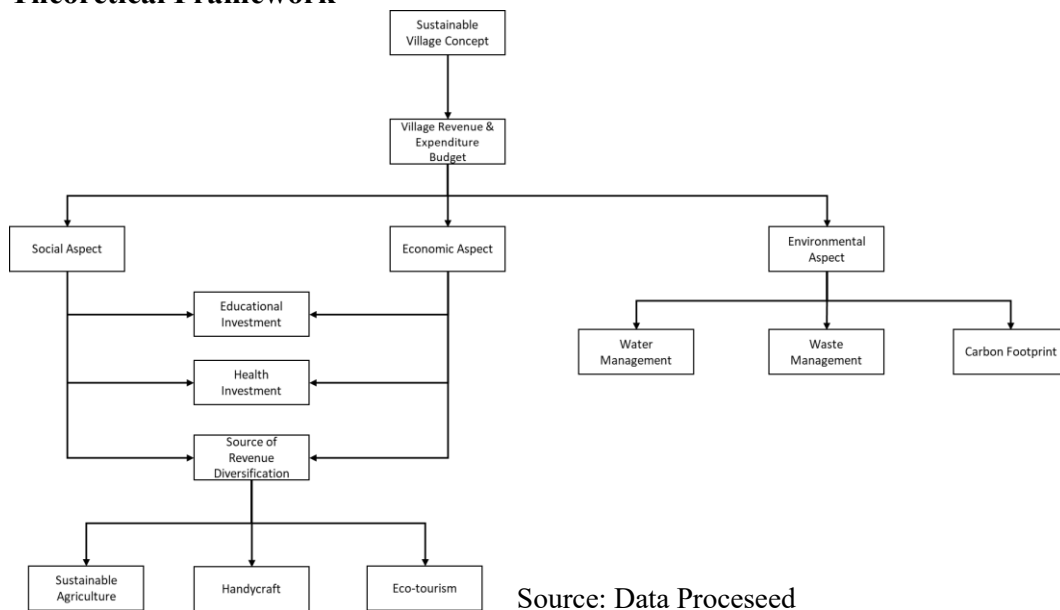
Number	Villages Name	City/Regency	Sustainable Village Practices
1	Pujon Kidul	Malang	The concept of sustainable tourism leverages natural beauty and agricultural and livestock activities.
2	Pentingsari	Yogyakarta	Known internationally and having received numerous awards, including being ranked among the top 100 sustainable destinations by Global Green Destinations Days (GGDD), the daily activities of the community living in harmony with nature are the main attraction.
3	Ponggok	Klaten	Leveraging five natural springs as tourist destinations, including the famous Umbul Ponggok, visitors can enjoy swimming, snorkeling, and underwater photography.

Number	Villages Name	City/Regency	Sustainable Village Practices
4	Kete Kesu	Toraja	Embracing a cultural preservation concept, this village's main tourist attractions include the traditional Rambu Solo ceremony and the over 300-year-old Tongkonan traditional houses. The village is also renowned for its wood carving and painting crafts.
5	Penglipuran	Bali	Known as one of the cleanest villages in the world and ranked among the top 100 sustainable destinations by GGDD, the village's customary regulations prohibit the use of motor vehicles within the village area to maintain air cleanliness.
6	Kampung Blekok	Situbondo	Home to various types of mangrove plants and thousands of nearly extinct herons, this village allows tourists to participate in bird conservation and care activities.

Source: Kemenparekraf/Baparekraf RI

Through the case studies mentioned above, it can be seen how these villages utilize natural resources, culture, and community participation to achieve balanced development goals across economic, social, and environmental aspects. The research to be conducted in Jubung Village and Karangpring Village will focus on implementing sustainable development concepts but with slightly different contexts. Jubung Village, located near the city center in Jember Regency, faces more intense challenges of urbanization and modernization. This research will explore how the village manages economic growth while maintaining budget management efficiency and social sustainability.

Theoretical Framework



The theoretical framework presented focuses on the concept of Sustainable Villages, divided into three main aspects: Social Aspect, Economic Aspect, and Environmental Aspect. Each aspect has interconnected components to support village sustainability (Comín, 2020).

All these components are connected within the framework of the Village Revenue and Expenditure Budget (APBDes), which serves as the basis for planning and implementing sustainable programs in the village (A. Rahman et al., 2021). With this approach, it is hoped that the village can achieve sustainable well-being by balancing social, economic, and environmental needs. The integration of these three aspects allows the village to develop holistically, creating a healthy community, a strong economy, and a sustainable environment (Jalilah Ilmiha et al., 2023; Rahayu et al., 2024).

3. RESEARCH METHOD

This research uses a qualitative approach with a case study design to explore innovations and challenges in sustainable village development (Creswell & Creswell, 2007). This approach allows for an in-depth exploration of complex phenomena in the real-life contexts of Jubung and Karangpring Villages in Jember Regency (Yin, 2018). The case study provides a comprehensive and detailed understanding of the issues being studied, making it suitable for understanding the dynamics of sustainable village development.

The research design involves several systematically integrated steps (Merriam & Tisdell, 2015). The first step is data collection through various methods such as in-depth interviews and document analysis (Patton, 2002). In-depth interviews will be conducted with key stakeholders in Jubung and Karangpring

Villages, such as the local village heads (Kvale & Brinkmann, 2009). Document analysis will include a review of official documents, reports, and records relevant to the implementation of sustainable village development.

In-depth interviews will be conducted semi-structured to allow flexibility in exploring topics that emerge during the interviews. Each interview will be recorded and transcribed for further analysis. The researcher will also collect and analyze official documents such as village development plans and the Village Revenue and Expenditure Budget (APBDes) in Jubung and Karangpring Villages (Bowen, 2009).

Data analysis will be conducted using a thematic analysis approach (Braun & Clarke, 2006). Data collected from interviews and documents will be organized, coded, and analyzed to identify key themes related to innovations and challenges in sustainable village development. This analysis process involves several stages: reading and understanding the data, identifying initial codes, grouping these codes into themes, and interpreting the themes in the research context. The researcher will use qualitative data analysis software to assist in data management and analysis. To ensure the validity and reliability of the research, several strategies will be implemented. Data triangulation will be used by combining data from various sources and data collection methods (Denzin, 2017). Member checking will be conducted by seeking feedback from interview participants on the initial findings of the research. The researcher will also note personal reflections and biases that might affect data interpretation.

This research will focus on exploring the innovations implemented in Jubung and Karangpring Villages to achieve sustainable development and identifying the challenges faced (Scoones, 2007). Through a local perspective, this study will highlight how both villages integrate social, economic, and environmental aspects into their development. The research will also explore the roles of various local actors, such as the village government, the community, and non-governmental organizations, in initiating and supporting these innovations.

4. RESULTS AND DISCUSSION

Village Sustainable Development

There are two villages in Jember that can be compared to see how sustainable village development can be implemented, namely Jubung Village and Karangpring Village. Village development is closely related to the role of the budget. The budget greatly determines the success or progress of a village. This was conveyed by the Head of Jubung Village, Mr. Bisma Perdana:

“So the larger the budget, if it is allocated appropriately, then the progress of an area or village will also be fast. But the size of the budget must also be accompanied by good accountability and responsibility...”

A similar sentiment was expressed by the Head of Karangpring Village, Mr. Ahmad Sahri:

“APBDes is very much needed. Why? Because if we only rely on the allocated budget, it will never be enough. Why? Because in the APBD (Regional Revenue and Expenditure Budget), each post has its own allocation...”

The budget is a tool used for planning and oversight (Siregar, 2020). Therefore, the budget is very important in planning village development. Village development begins with planning that starts from mapping village potential, hamlet deliberations, and village deliberations. In these deliberations, priority programs for village development will be established. This aligns with the statement of the Head of Jubung Village, Mr. Bisma Perdana:

“Normatively, that’s how it is, and it must be done in stages to maximally absorb community participation. So, the mechanism first involves hamlet meetings, which then escalate to hamlet-level deliberations. These deliberation proposals are brought to the village deliberations, where decisions are made.”

A similar sentiment was expressed by the Head of Karangpring Village, Mr. Ahmad Sahri:

“I invite the community at the planning stage. Before we carry out activities, we involve the hamlet heads and the sub-district authorities. So, in the planning process, I invite them all because they know the conditions on the ground, both in terms of their environment, what is needed, what should be done first, what should be prioritized...”

To illustrate the importance of the APBDes in village development, we can look at the budget allocations for 2023 in Karangpring and Jubung Villages presented in the tables below.

Table 2. Karangpring’s 2023 Budget Allocation
VILLAGE REVENUE AND EXPENDITURE BUDGET
KARANGPRING VILLAGE GOVERNMENT
YEAR 2023

DESCRIPTION	TOTAL BUDGET (IDR)
REVENUE	
Revenue	2,637,074,898.00
Financing Receipts	4,000,000.00
Total Revenue	2,641,074,898.00
EXPENDITURES	
Fixed Salary and Allowances for The Village Head	46,500,000.00
Fixed Salary and Allowances for Village Officials	327,930,000.00
Honorarium Expenses	109,745,000.00
Capital Expenditures for Buildings, Structures, and Parks	227,178,800.00
Equipment and Supplies Expenses	75,151,534.00
Goods and Services Distributed to the Community	191,517,100.00
Office Operational Expenses	147,753,000.00
Capital Expenditures for Roads/Road Infrastructure	852,768,200.00

Capital Expenditures for Irrigation/Reservoirs/Drainage/Wastewater/Sanitation	241,437,900.00
Unexpected Expenditures	226,000,000.00
Village Capital Investment	50,000,000.00
Social Security for Village Head and Officials	33,534,364.00
Village Consultative Body (BPD) Allowances	57,777,000.00
Capital Expenditures for Equipment, Machinery, and Heavy Equipment	53,782,000.00
Total Expenditures	2,641,074,898.00

Source: Siskeudes Karangpring

Table 3. Jubung's 2023 Budget Allocation
VILLAGE REVENUE AND EXPENDITURE BUDGET
JUBUNG VILLAGE GOVERNMENT
YEAR 2023

DESCRIPTION	TOTAL BUDGET (IDR)
REVENUE	
Revenue	1,886,777,261.26
Financing Receipts	1,886,777,261.26
Total Revenue	
EXPENDITURES	177,000,000.00
Fixed Salary and Allowances for The Village Head	299,584,000.00
Fixed Salary and Allowances for Village Officials	137,856,000.00
Honorarium Expenses	98,005,000.00
Capital Expenditures for Buildings, Structures, and Parks	22,107,636.00
Equipment and Supplies Expenses	127,842,300.00
Goods and Services Distributed to the Community	135,800,000.00
Office Operational Expenses	414,717,900.00
Capital Expenditures for Roads/Road Infrastructure	200,864,300.00
Capital Expenditures for Irrigation/Reservoirs/Drainage/Wastewater/Sanitation	49,741,500.00
Unexpected Expenditures	122,400,000.00
Village Capital Investment	5,000,000.00
Social Security for Village Head and Officials	30,843,572.00
Village Consultative Body (BPD) Allowances	62,477,000.00
Capital Expenditures for Equipment, Machinery, and Heavy Equipment	1,884,239,208.00
Total Expenditures	2,538,053.26

Source: Siskeudes Jubung

The above tables show the detailed allocations of the APBDes in Karangpring and Jubung Villages. In Karangpring Village, which is known as a Rose Village, significant portions of the budget are allocated to infrastructure development, such as road and irrigation systems, to support the local agriculture and tourism sectors. The allocation includes expenditures for community services, operational costs, and social security for village officials. On the other hand, Jubung Village, known as an Urban Village, allocates its budget to various urban

infrastructure projects, community services, and maintenance of public facilities. The budget also includes allocations for operational expenses and social security. It is clear that both villages prioritize infrastructure and community services, essential components for sustainable development. These allocations reflect the villages' commitment to enhancing the quality of life for their residents and ensuring long-term sustainability through careful and strategic use of the APBDes.

Social Aspect

The priority programs determined in the village deliberations will later be ratified into the APBDes. A well-structured APBDes will support a progressive and sustainable village. The first aspect needed to achieve sustainable village development is the social aspect, which includes investments in education and health to improve the quality of life of the villagers.

Economical Aspect

The second aspect is the economic aspect in the concept of sustainable villages, which involves income diversification. This ensures that the village economy does not rely on a single sector but develops through various sources of income. Some forms of income diversification include sustainable agriculture, handicrafts, and ecotourism.

Environmental Aspect

a) Water Management

In terms of water management, Karangpring Village does not have a specific water management system. The village relies on mountain spring water, which is distributed to residents for daily use. This potential could be a business opportunity for Karangpring Village, such as establishing a drinking water business. However, currently, these water sources are only used for the community's daily needs.

b) Waste Management

Both Jubung and Karangpring Villages have waste management initiatives, specifically through Waste Banks. Jubung Village has a Waste Bank where residents' waste is collected and then sent to the landfill. However, the Waste Bank in Jubung Village currently serves as a collection point without processing waste into other value-added products.

Unlike Jubung Village, which already has a Waste Bank, Karangpring Village is still in the initial stages of establishing one. Additionally, some residents in Karangpring Village have started waste processing businesses, such as producing liquid fertilizer.

c) Carbon Footprint

The concept of a carbon footprint refers to the total amount of greenhouse gases, primarily carbon dioxide, that are emitted directly or indirectly by human activities. This includes emissions from the production and consumption of goods and services, transportation, energy use, and waste management. Understanding and managing the carbon footprint is crucial in the global effort to mitigate climate change, as it helps identify the main sources of emissions and develop strategies to reduce them. By calculating the carbon footprint, communities and organizations

can take concrete steps towards more sustainable practices and reduce their impact on the environment.

In the context of village development, calculating the carbon footprint from the Village Revenue and Expenditure Budget (RAPBDes) can provide valuable insights into how village activities contribute to greenhouse gas emissions. The RAPBDes outlines the financial planning and resource allocation for various sectors within the village, including infrastructure development, public services, and economic activities. By analyzing the RAPBDes, it is possible to identify key areas that contribute to the carbon footprint and quantify their impact.

To calculate the carbon footprint from the RAPBDes, the following steps can be undertaken:

1. Assessing the electricity in the budget for village operations.
2. Examining the budget allocations for transportation-related activities. Calculate the emissions based on fuel consumption and the types of vehicles used.
3. Analyzing the budget allocations for agricultural projects and local industries.
4. Reviewing the expenditures on public services like water supply, sewage treatment, and infrastructure development.
5. Converting other relevant budget items that may contribute to the carbon footprint.

Based on the stages of carbon footprint calculation from the Environmental Protection Agency (EPA), the conversion of the budget into the amount of carbon emissions from Jubung and Karangpring Villages can be obtained as shown in the following table. It is important to note that not all the budget allocation can be converted into calculating carbon emissions, only specific budget items that have direct carbon implications are included.

Table 4. Conversion Table of Budget Allocation to Carbon Emission

Description	Amount in Rupiah		Total Carbon (mtons)	
	Jubung	Karangpring	Jubung	Karangpring
Foods and Beverages	Rp3,000,000	Rp8,500,000	0.17	0.48
Medicines	Rp3,192,116	-	0.09	0.00
Clothes, Cloth, and Shoes	Rp5,000,000	Rp17,328,450	0.09	0.31
Paper based Products	Rp1,000,000	Rp1,300,000	0.04	0.05
IT Tools and Machinery	Rp13,420,000	Rp46,582,000	0.47	1.62
Vehicles	Rp49,741,500	-	2.09	0.00
Raw Materials	Rp555,800,200	Rp832,067,100	15.11	22.62
Telephones and Electricity	Rp6,000,000	Rp15,600,000	0.20	0.52
Office Activities	Rp12,077,636	Rp44,853,875	0.16	0.60
Total	Rp649,231,452	Rp966,231,425	18.42	26.21

Source: Data Processed

The data shows the comparison between the carbon footprints of Jubung and Karangpring Villages. The total carbon footprint for Jubung is 18.42 metric tons of CO₂, while Karangpring has a higher footprint of 26.21 metric tons of CO₂.

In Jubung Village, the most significant contributor to the carbon footprint is raw materials, with 15.11 metric tons of CO₂. This highlights the need for sourcing eco-friendly materials and improving supply chain efficiency. The use of motor vehicles also contributes significantly, with a carbon footprint of 2.09 metric tons. IT, machinery, and computers contribute 0.47 metric tons, emphasizing the importance of strategies to extend the lifespan of devices, recycle e-waste, and choose energy-efficient products. Food and beverages, medicines, clothing, fabric, and shoes have smaller impacts, contributing 0.17, 0.09, and 0.09 metric tons of CO₂, respectively. Paper-based products and office activities add 0.04 and 0.16 metric tons of CO₂, respectively. Telephone and electricity expenses contribute 0.20 metric tons.

In Karangpring Village, raw materials also have a significant carbon footprint, amounting to 22.62 metric tons of CO₂. IT, machinery, and computers have a notable impact, contributing 1.62 metric tons. Food and beverages contribute 0.48 metric tons, while clothing, fabric, and shoes add 0.31 metric tons. Paper-based products and office activities contribute 0.05 and 0.60 metric tons, respectively. Telephone and electricity expenses add 0.52 metric tons.

The total carbon footprint of Karangpring Village is higher than that of Jubung Village. The major contributors to Karangpring's carbon footprint are raw materials, IT tools and machinery, and also telephones and electricity. On the other hand, Jubung's carbon footprint is mainly from raw materials and motor vehicles. By focusing on sourcing eco-friendly materials, extending the lifespan of IT devices, using locally produced and organic foods, enhancing energy efficiency in office operations, and reducing paper use, both villages can significantly reduce their overall carbon footprints and promote more sustainable practices.

Discussion

The Villages Innovation

Karangpring and Jubung Villages have made several efforts to support sustainable development. In Karangpring, the village proposed a waste bank and processes rose waste into compost and liquid fertilizer to support rose farming. They also developed Rose Monument Ecotourism, since many residents grow roses which are more profitable than rice or corn. Although there are challenges in equipment and marketing, the village continues to add value to local products and plans to create a local market for agricultural and livestock goods. Karangpring residents are also involved in village budgeting (APBDes) to ensure local needs are met. The village holds regular training, such as using coffee husks and processing roses, and collaborates with external agencies to raise awareness about sustainability.

Meanwhile, Jubung Village focuses on supporting small businesses, especially local coffee producers, by providing tools like grinders to help them grow and compete. The village also builds eco-friendly infrastructure, such as drainage systems to prevent flooding. Although waste management is still developing, they have created temporary waste collection points and assigned workers to manage household waste, with plans for a better recycling system. Community members are involved in budgeting discussions and help decide village priorities, which include

supporting residents, improving health and education services, and building infrastructure like irrigation and retaining walls. Despite limited budgets, both villages are actively promoting sustainability through innovation, community involvement, and environmental awareness. Their efforts show how local actions can lead to meaningful progress in creating a better, more sustainable future.

The Villages' Limitation

Despite the notable efforts and innovations in sustainable practices, both Jubung and Karangpring Villages face several limitations in their journey towards becoming sustainable villages. Karangpring has the primary limitation of constrained financial resources that hinder the comprehensive implementation of sustainable projects. Many planned initiatives, such as advanced waste management systems and extensive eco-tourism infrastructure, require significant investment that is currently unavailable. Although there is a waste management system in place, it is not fully effective. The village lacks advanced facilities for recycling and transforming waste into economically valuable products, limiting the potential environmental and economic benefits. There is also the absence of trained personnel to manage and operate sustainable projects, such as waste management and eco-tourism initiatives, poses a significant challenge. This gap in expertise limits the efficiency and sustainability of these projects. Lastly the limited access to larger markets for products such as processed roses and local crafts can restrict economic growth and the full realization of economic sustainability goals.

Meanwhile, even though Jubung has made progress in building infrastructure, the lack of comprehensive planning and sufficient funds restricts the ability to maintain and expand these facilities to fully meet the village's needs. Similar to Karangpring, waste management in Jubung is still a work in progress. The existing system is basic and does not yet include comprehensive recycling or waste-to-product initiatives, which are necessary for reducing environmental impact and generating additional income. Although there is a strong emphasis on community involvement, social conflicts and misunderstandings about prioritization can arise, especially when budget limitations prevent immediate implementation of all proposed projects. The village's economic activities are still relatively concentrated in a few areas, such as small businesses and agriculture. Diversification into other sustainable economic activities is limited by both funding and market access.

The Strategy to Establish Sustainable Village

Establishing a sustainable village requires a multi-faceted strategy that addresses economic, environmental, and social aspects while overcoming the limitations identified in both Jubung and Karangpring Villages. Based on the research results, the following strategies can be implemented:

1. Enhancing financial resources,
2. Improving waste management systems,
3. Promoting eco-tourism,
4. Economic diversification,
5. Infrastructure development,

6. Community engagement and education, and
7. Technical expertise and training,

The budget allocations in Jubung and Karangpring Villages reflect both their current priorities and long-term plans for sustainable development. In Karangpring, large investments in roads and irrigation are not just for physical improvement but are aimed at boosting agriculture and tourism, two key parts of the local economy. Both villages also prioritize education and health, showing their belief that improving human resources is essential for long-term growth. By focusing on education, they are preparing a skilled and knowledgeable future workforce.

Karangpring is also trying to diversify its economy by shifting to sustainable farming and producing rose-based products, which helps reduce reliance on one crop. However, challenges like limited access to modern tools and markets remain. The villages are also developing ecotourism by using natural and cultural assets, which helps bring in income while preserving the environment and traditions. In terms of environmental sustainability, Karangpring's use of spring water is promising, but the lack of proper water management systems could become a problem in the future. Both villages also need better waste management, as current systems focus only on collection, with little recycling or reuse. Additionally, high emissions from materials and transportation show the need for greener energy and better energy efficiency.

To move forward, both villages need a more complete approach to sustainability that balances economic, social, and environmental goals. This includes finding new funding sources and investing in education and training so that local people can continue and expand these efforts. Jubung and Karangpring have the potential to become strong examples of how small communities can lead sustainable development through creative, local solutions, with the right support.

Conclusion

The comparison between Jubung and Karangpring Villages shows how important the Village Revenue and Expenditure Budget (APBDes) is for supporting sustainable development. Even with limited funds, both villages have made good progress by carefully planning and managing their budgets. Karangpring focuses on agriculture and eco-tourism, investing in infrastructure and community services to improve quality of life and support sustainability. Jubung, with its more urban setting, emphasizes infrastructure and support for small businesses to strengthen its economy.

However, the study has some limitations. It only uses available data from 2023, so it may not fully represent all village activities or long-term changes. Only certain budget items were analyzed for carbon emissions, and the qualitative data from interviews may include bias. The study also assumes some technical knowledge, which might make it less accessible for village leaders unfamiliar with carbon accounting.

Despite these limitations, the findings offer valuable insights for policymakers and other villages. They show that with smart budgeting and

community involvement, sustainable development is possible even with limited resources. Other villages can learn from Jubung and Karangpring's example by involving residents in planning, supporting eco-friendly practices, and diversifying their economies. Educational programs about sustainability can also help communities make better decisions and build a more sustainable future.

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