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“**Architecture and Sustainability Pathways for Rural Development in Indonesia**”

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Architecture and Sustainability Pathways for Rural Development in Indonesia

Cut Sannas Saskia
Universitas Trisakti

Etty Retnowati Kridarso
Universitas Trisakti

Ulfa Fatmasari
Universitas Trisakti

Maria Immaculata Ririk Winandari
Universitas Trisakti

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Abstract

Rural landscapes in Indonesia reflect the coexistence of strong agrarian traditions and the pressing need for sustainable development, requiring approaches that integrate ecological, spatial, and socio-economic systems. Ciambar District in Sukabumi Regency, West Java, serves as a representative case study, characterized by agricultural activities such as rice, cassava, and durian cultivation, extensive forest areas, and ecotourism potential, including Curug Luhur Waterfall. Despite these assets, the district faces persistent challenges, including inadequate infrastructure, unequal access to clean water, and heavy reliance on small-scale agriculture. From the perspective of architectural sustainability, Ciambar must be re-envisioned as an integrated landscape of productive, ecological, and social spaces. Approaches such as productive landscapes, ecological infrastructure, and low-impact ecotourism demonstrate how spatial and architectural interventions can simultaneously support livelihoods, conserve ecosystems, and enhance local resilience. This study aims to identify, analyze, and map the potentials of Ciambar District based on natural resources, human capital, and local governance capacity. The findings are expected to provide a comprehensive assessment of existing strengths and

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Lt. 4 Gedung ITB Ahmad Dahlan Jakarta, Kampus Ciputat
Jl. Ir. H. Juanda No. 77 Cirendeu, Ciputat, Tangerang Selatan 15419
Telp. (021) 743 0930 Fax. (021) 749 1100

Email: rustic.ars.itb.ad@gmail.com

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Architecture and Sustainability Pathways for Rural Development in Indonesia

Cut Sannas Saskia[1*], Etty R Krisdarso[2], Ulfa Fatmasari Faisal[3], Maria Immaculata Ririk Winandari[4]
[1,2,4]Architecture Department, Faculty of Civil Engineering & Planning, Universitas Trisakti, DKI Jakarta, Indonesia
[3] Civil Engineering Department, Faculty of Civil Engineering & Planning, Universitas Trisakti, DKI Jakarta, Indonesia

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ABSTRACT

Rural landscapes in Indonesia reflect the coexistence of strong agrarian traditions and the pressing need for sustainable development, requiring approaches that integrate ecological, spatial, and socio-economic systems. Ciambar District in Sukabumi Regency, West Java, serves as a representative case study, characterized by agricultural activities such as rice, cassava, and durian cultivation, extensive forest areas, and ecotourism potential, including Curug Luhur Waterfall. Despite these assets, the district faces persistent challenges, including inadequate infrastructure, unequal access to clean water, and heavy reliance on small-scale agriculture. From the perspective of architectural sustainability, Ciambar must be re-envisioned as an integrated landscape of productive, ecological, and social spaces. Approaches such as productive landscapes, ecological infrastructure, and low-impact ecotourism demonstrate how spatial and architectural interventions can simultaneously support livelihoods, conserve ecosystems, and enhance local resilience. This study aims to identify, analyze, and map the potentials of Ciambar District based on natural resources, human capital, and local governance capacity. The findings are expected to provide a comprehensive assessment of existing strengths and opportunities, along with strategic recommendations for sustainable environmental development that supports the local economy while aligning with broader sustainability frameworks.

Corresponding Author:

Cut Sannas Saskia
Architecture Department, Faculty of Civil Engineering & Planning, Universitas Trisakti, Kampus A, Jl. Kyai Tapa, Kota Jakarta Barat, Daerah Khusus Ibukota Jakarta 11440
Email: cutsannas@trisakti.ac.id

1. INTRODUCTION

Rural landscapes in Indonesia reflect both the persistence of traditional agrarian practices and the urgent need for sustainable development amid rapid socio-economic transitions. The concept of rural itself is tied to a low density area where the social hierarchy and roles, such as gender, religion, race, ethnicity, and class, which are often overlooked in rural development conversations [1]. Ciambar District, located in Sukabumi Regency, West Java, offers a critical case study in this discourse. Situated at an altitude of approximately 700 meters above sea level and covering 3,820 hectares, the district's spatial and socio-economic structure is dominated by rice fields, cassava and durian plantations, and extensive forest areas. These resources are complemented by ecotourism attractions such as Curug Luhur waterfall, which holds potential to diversify livelihoods through nature based tourism. Despite this wealth of resources, Ciambar faces persistent challenges

including infrastructure deficits, inequitable access to clean water, and economic dependency on small-scale agriculture. These issues situate Ciambar as a representative case of rural Indonesia, where natural endowments coexist with systemic vulnerabilities, thereby demanding an integrated approach that merges architectural landscape planning, sustainability frameworks, and socio-economic empowerment [2]. This study aims to identify, analyze, and map the potential of Ciambar District, based on natural resources, human resources, and the authority of the local government. The study is expected to provide a comprehensive discussion of existing strengths and opportunities, as well as deliver targeted recommendations for sustainable environmental development that will enhance the economic sector.

Several aspects will be the focus of this study, including agricultural potential, plantation potential, tourism potential, creative industry potential, and human resource potential that can support regional development. The local government uses local economic development to discover and capitalize on the region's potential, increasing community welfare while promoting regional growth, particularly in rural areas that are mostly dominated by agricultural operations [3]. Through a holistic and data-driven approach, particularly using secondary data, this study is expected to make a tangible contribution to the local government and other stakeholders in formulating policies and development strategies for Sukabumi Regency.

In rural settings, architecture extends beyond the construction of buildings to encompass landscapes, infrastructures, and spatial systems that mediate interactions between people and the environment. Sustainable architectural discourse emphasizes ecological sensitivity, adaptive design, and socio-economic resilience as interdependent components of development [2]. This study adopts that perspective, positing that Ciambar's future development hinges on reconceptualizing its agricultural, ecological, and social spaces as interconnected systems. Such integration is particularly salient as agriculture remains the backbone of the local economy, yet diversification into ecotourism and small-scale industries has become increasingly essential to strengthen livelihoods. The adaptive capacity of local communities is both distinctive and multifaceted, serving as a bridge between conservation efforts and the sustainable utilization of ecosystem services. Spatial design can be used to mediate buildings and communities, as it facilitates community involvement and a feeling of belonging [4]. When communities are actively engaged in co-management and co-production processes, their participation strengthens socio-ecological resilience, thereby supporting the long-term availability of resources for ecotourism as well as food systems and agroecosystems. In creative placemaking, community participation is often regarded as a mandatory tool in changing community perception towards the development of a place [5]. Moreover, socio-ecological resilience plays a pivotal role in ensuring the sustainability of ecotourism [6].

The global policy framework of the United Nations' Sustainable Development Goals (SDGs) provides an analytical lens for situating Ciambar's developmental trajectory. Among the 17 SDGs, three are especially relevant to Ciambar: SDG 8 on decent work and economic growth, SDG 11 on sustainable cities and communities, and SDG 13 on climate action. Aligning local strategies with these global targets ensures that Ciambar's development contributes not only to regional prosperity but also to broader sustainability agendas [7], [8]. Against this backdrop, the objective of this study is to identify, analyze, and map the district's potentials and challenges through the lens of architecture and sustainability, while formulating recommendations that reinforce local strengths and address existing gaps.

The relationship between architecture and sustainability has been the subject of considerable scholarly debate over the last two decades. Sustainable architecture is increasingly defined not only by its technical efficiency but also by its ability to embed ecological and socio-economic resilience within spatial systems [2]. Sustainable architectural principles are applied to the development of an urban area, which automatically fulfills the needs of creating a healthy city [9]. Scholars emphasize that sustainability in rural settings requires integrating ecological design principles into landscapes, infrastructure, and settlements, thereby producing spatial configurations that are adaptive and regenerative rather than extractive [10], [11].

Architecture in rural contexts often functions at the scale of landscapes rather than isolated buildings. Productive landscapes agricultural spaces that combine food production, ecological services, and social uses are considered central to sustainable rural development [12]. These landscapes align with the idea of multifunctionality, where agriculture contributes simultaneously to livelihoods, biodiversity conservation, and cultural identity. Furthermore, architectural approaches to rural infrastructure increasingly emphasize "green infrastructure," defined as interconnected networks of natural and semi-natural systems that deliver ecosystem services while supporting human needs [8].

Rural development literature highlights the necessity of embedding sustainability principles in economic diversification, community participation, and environmental management [13]. In Indonesia, rural economies remain predominantly agricultural, but the volatility of commodity markets and environmental degradation pose risks to long-term viability. Diversification into ecotourism and small-scale enterprises has been identified as a critical pathway to enhance resilience [14], provided that such strategies are anchored in community empowerment and ecological conservation.

Participatory approaches have been increasingly acknowledged in both sustainability science and architectural practice as essential for ensuring the legitimacy and effectiveness of interventions [11]. Studies demonstrate that rural communities are more likely to embrace sustainability initiatives when they are involved in the design, planning, and management of spaces [15]. For Ciambar, integrating participatory mapping with architectural landscape analysis provides an avenue for reconciling top-down planning with bottom-up knowledge, creating outcomes that are both spatially coherent and socially relevant.

The SDGs serve as a unifying framework for linking local rural development with global sustainability objectives. Empirical studies in Southeast Asia show that aligning rural development strategies with SDG targets can enhance resilience, particularly when interventions address employment, infrastructure, and ecological conservation in tandem [13]. In the context of Ciambar, this alignment underscores the potential of architecture and sustainability approaches to serve as mediating frameworks between global policy and local realities.

2. METHOD

This study employed a descriptive-analytical study design that integrates spatial observation, participatory mapping, and secondary data analysis. The rationale for using a descriptive analytical approach lies in its ability to synthesize empirical field observations with theoretical frameworks of architecture and sustainability, thereby producing a holistic understanding of Ciambar's potentials and constraints. Fieldwork was conducted across key sectors of Ciambar's landscape, including agricultural fields, plantation areas, forest ecosystems, ecotourism sites, and community infrastructure. Observational data were systematically recorded with respect to land-use patterns, the physical condition of built and natural environments, and infrastructural systems such as road connectivity, water distribution networks, sanitation, and public facilities. This approach is consistent with established practices in landscape architecture study, where spatial analysis is grounded in empirical field data [10].

A participatory mapping component was incorporated to ensure the inclusion of local knowledge and aspirations. Participatory mapping in rural areas, especially done by locals, provides a more relevant data that will in turn be a more contextual and usable resource [16]. This was operationalized through focus group discussions with residents, interviews with community leaders, and consultations with district officials. Participatory approaches are increasingly emphasized in sustainable architecture and planning as they facilitate shared ownership and enhance the cultural legitimacy of proposed designs [11]. Data triangulation was achieved by comparing field observations, spatial analysis, and stakeholder narratives, thereby strengthening the validity of findings.

3. RESULTS AND DISCUSSION

The analysis revealed that Ciambar District embodies both significant potentials and structural challenges, positioning it as a landscape of opportunities constrained by systemic limitations.

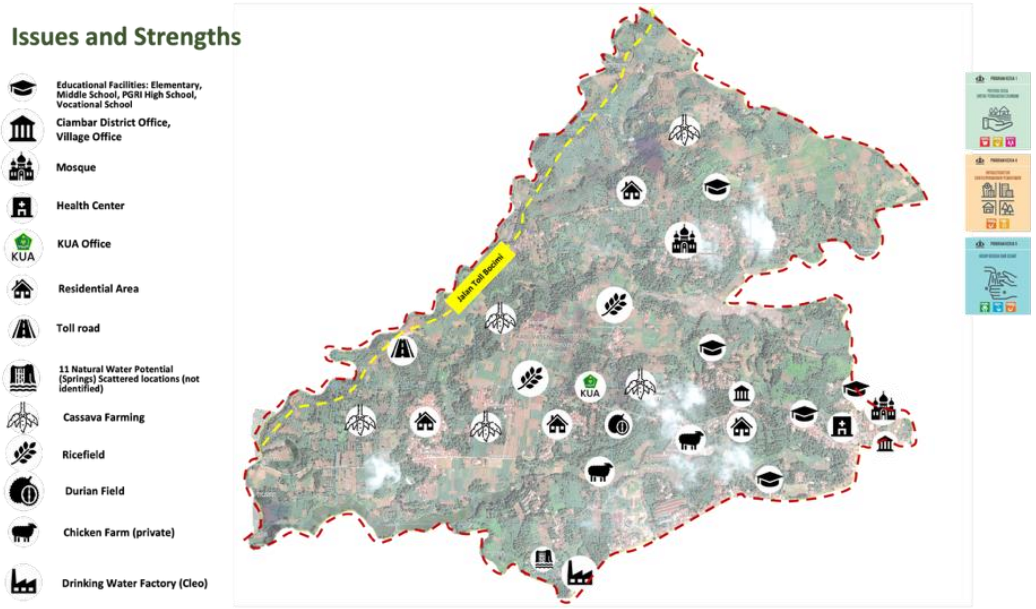

Figure 1. Mapping Strengths and Issues in Ciambar District

Agriculture emerged as the dominant sector, with rice, cassava, and durian plantations forming the foundation of household livelihoods. Cassava, in particular, plays a strategic role in the local economy, not only as a subsistence crop but also as a raw material for micro, small, and medium enterprises (MSMEs). Products such as modified cassava flour (mocaf), kecimpring, and opak are increasingly integrated into local value chains. However, the growth of these enterprises is constrained by inadequate access to hygienic production spaces, limited financial capital, and insufficient capacity in digital marketing platforms. Similar patterns of constrained agribusiness development have been observed across rural Indonesia, where infrastructural deficits undermine the potential of agricultural value chains.

The presence of Curug Luhur waterfall and surrounding forest ecosystems represents a strong potential for ecotourism. The area's natural assets could be developed through eco-architectural interventions such as environmentally sensitive trails, community-managed visitor facilities, and interpretive signage. Empirical studies from other Indonesian regions demonstrate that ecotourism, when coupled with ecological architecture, can enhance rural livelihoods while safeguarding biodiversity. Nonetheless, infrastructural barriers such as poor road conditions and the lack of accommodation facilities limit the viability of expanding ecotourism. Without careful spatial planning, there is also a risk that tourism development could exacerbate ecological degradation rather than contribute to sustainability [8].

Ciambar possesses 11 natural springs that could potentially provide sustainable sources of water for households and agricultural irrigation. However, several of these springs are under private control, resulting in inequitable distribution. Approximately 20 households were documented as lacking access to clean water, while 90 households continue to rely on communal sanitation facilities. These deficiencies compromise public health and hinder the growth of MSMEs that depend on hygienic processing environments. Studies have shown that inadequate access to water and sanitation is a persistent constraint on rural development across Southeast Asia [13].

Infrastructure, which in rural Indonesia has not experienced significant development in the last 20 years [17], emerged as the most significant limiting factor. Many inter-village road connections remain unpaved, restricting the mobility of residents and the transportation of agricultural products. This infrastructural weakness not only reduces market accessibility but also hampers the district's ability to attract tourists. Similarly, access to basic services such as healthcare and education remains uneven, further constraining socio-economic mobility. These findings align with broader studies indicating that infrastructural deficits are among the most critical barriers to sustainable rural development.

The findings of this study highlight the importance of reimagining Ciambar District through the lens of architecture and sustainability. In architectural terms, the district is not merely a collection of agricultural fields, forests, and settlements, but rather a dynamic landscape of interconnected productive, ecological, and social spaces. Sustainable architecture provides a framework to design and manage these relationships so that they enhance both resilience and functionality [2], [10].

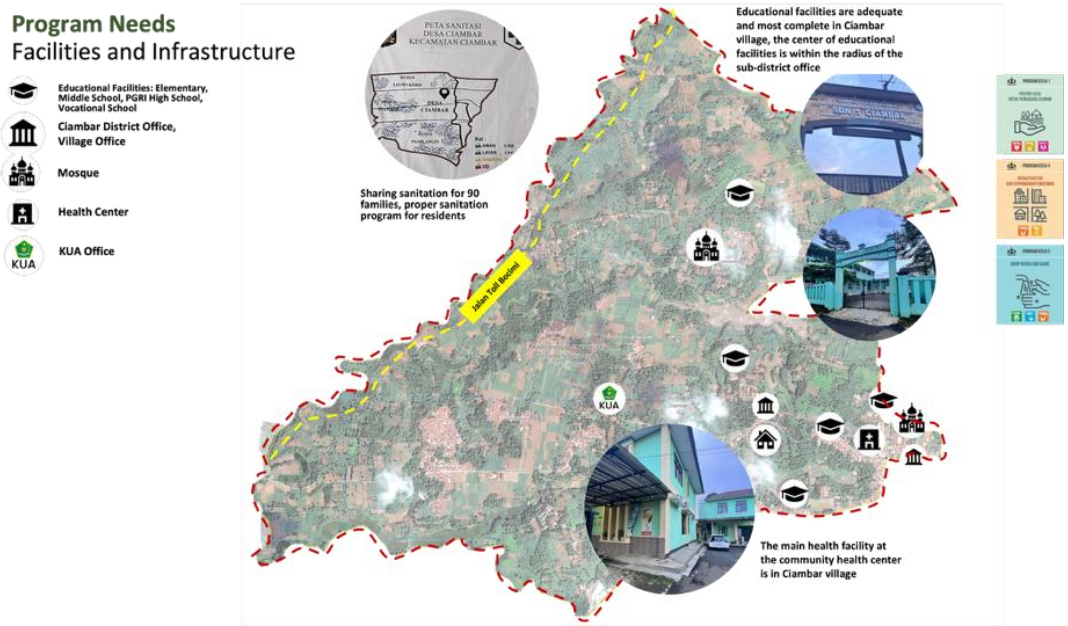

Figure 2. Program Needs in Ciambar District

One of the central arguments in the discourse of sustainable architecture is the notion of productive landscapes, that perform multiple ecological, economic, and social functions simultaneously [12]. For Ciambar, this means that cassava and durian plantations should not be regarded only as economic assets but also as potential educational and tourism spaces. Farm based education programs could introduce principles of agroecology to schoolchildren, while architectural interventions such as multi-purpose pavilions could integrate food processing, community gatherings, and visitor experiences. This multifunctional approach aligns with global calls to integrate food systems, ecological services, and social infrastructures in rural design [18].

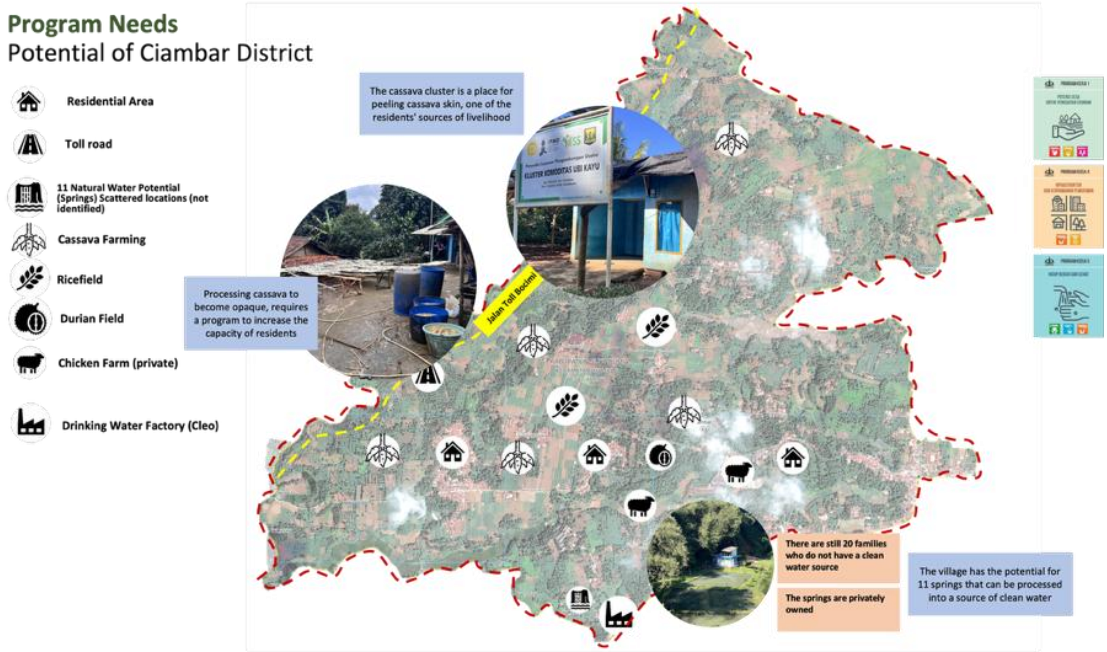

Figure 3. Mapping Strengths based on Program Needs in Ciambar District

Ecotourism development in Ciambar, particularly around Curug Luhur, illustrates the potential of ecological architecture. By adopting low impact design strategies such as elevated walkways, local material construction, and renewable energy integration, visitor facilities could blend with the natural landscape while minimizing environmental degradation. Study on community based ecotourism in Bali and other parts of Indonesia demonstrates that such architectural approaches can yield significant socio-economic benefits without compromising ecological integrity. Importantly, community participation in both design and management must be emphasized, since ecotourism that marginalizes local stakeholders often results in inequitable outcomes [11].

Infrastructure deficiencies in Ciambar must also be reframed through the perspective of green infrastructure. Rather than treating infrastructure as purely technical systems, sustainable design approaches emphasize its multifunctionality. Roads, for instance, could be designed as ecological corridors that integrate drainage channels, green strips, and pedestrian pathways. This is consistent with contemporary scholarship that frames green infrastructure as a means to enhance resilience, biodiversity, and human well-being simultaneously [8]. For Ciambar, such a reorientation could address mobility constraints while strengthening ecological connectivity.

Table 1. Summary of Spatial Issues, Potentials, and Development Needs in Ciambar District

Sector	Key Issues	Existing Strengths / Potentials	Identified Program Needs
Livelihood and Local Economy	Cassava processing remains traditional with low added value and limited production capacity among residents.	A cassava commodity cluster exists and serves as one of the main sources of livelihood for the community.	Capacity-building programs are needed to improve cassava processing techniques and develop value-added agro-industrial products.

Water Resources and Clean Water Access	Around 20 households do not have access to clean water due to limited communal infrastructure and private ownership of springs.	The village possesses 11 natural springs with strong potential to be developed as clean water sources.	Community-based clean water infrastructure and shared water resource management systems are required.
Sanitation	Approximately 90 households still rely on shared sanitation facilities.	Basic sanitation infrastructure is already available in several parts of the village.	Household-scale sanitation improvement and hygiene awareness programs are necessary.
Education Facilities	Educational facilities are unevenly distributed across the district.	Ciambar Village functions as the educational center with relatively complete facilities within the sub-district service radius.	Improved accessibility and supporting facilities are needed for residents in peripheral areas.
Health Facilities	Health services are concentrated in the village center, limiting access for outer areas.	The main community health center is located in Ciambar Village.	Expansion of health service coverage and improvement of supporting health infrastructure are required.
Infrastructure and Accessibility	Local road connectivity remains limited in certain areas.	The district benefits from strategic access through the Bocimi Toll Road.	Enhancement of local road networks is needed to support mobility and economic activities.
Institutional and Public Facilities	Public services remain centralized and require travel from remote settlements.	Key public and religious institutions are already established within the district.	Decentralization and strengthening of village-level public services are needed.
Agriculture and Natural Resources	Agricultural activities are dominated by primary production with limited diversification.	Fertile agricultural land and strong farming traditions characterize the district.	Sustainable agriculture and diversification programs are required to increase resilience and productivity.
Settlement and Housing	Housing quality varies across different settlement areas.	Rural settlement patterns show strong social cohesion and community structure.	Integrated housing improvement programs linked with sanitation and clean water provision are needed.

The role of architecture in supporting MSMEs also deserves emphasis. The design and provision of shared hygienic processing spaces could dramatically improve the quality and competitiveness of local products. These facilities should integrate ecological principles such as natural ventilation, energy efficiency, and modular adaptability. Architectural studies in Southeast Asia have shown that such catalytic spaces not only enhance production capacity but also foster social interaction and innovation within communities. By linking physical spaces with socio economic empowerment, architecture becomes a driver of local development.

The integration of Ciambar's potentials and challenges with the Sustainable Development Goals (SDGs) underscores the global relevance of local action. Efforts to diversify agriculture and strengthen MSMEs directly contribute to SDG 8 on decent work and economic growth. The reorganization of village spaces through ecological architecture supports SDG 11 on sustainable cities and communities. Conservation of forest and water resources, together with low-carbon tourism development, advances SDG 13 on climate action. This reinforces the argument that architecture and sustainability must be viewed as systemic interventions that bridge the local and global scales of development [13].

4. CONCLUSION

Ciambar District epitomizes the paradox of rural Indonesia: rich in natural and cultural resources but constrained by infrastructural and socio-economic vulnerabilities. This study has demonstrated that an architectural and sustainability perspective provides a valuable framework for reimagining the district's

development trajectory. By treating agricultural areas as multifunctional productive landscapes, developing ecotourism with ecological sensitivity, and rethinking infrastructure as green corridors, Ciambar can transition toward a sustainable rural model. The empowerment of MSMEs through architecturally designed shared facilities further highlights the intersection between space, economy, and society. Such interventions not only improve economic outcomes but also foster social cohesion and innovation, reinforcing the role of architecture as both a spatial and socio-economic catalyst.

The implications of this study extend in two directions. At the practical level, it offers spatially grounded strategies for policymakers and local communities, emphasizing the integration of ecological design, community participation, and sustainability principles. At the academic level, it contributes to the discourse on rural architecture and sustainable development by demonstrating how spatial analysis and participatory methods can inform transformative pathways in resource-rich but infrastructure-poor regions. Future study could expand this study through quantitative assessments of environmental impacts, exploration of financing mechanisms for sustainable infrastructure, and comparative analysis with other rural districts in Indonesia and Southeast Asia. Such work would deepen the understanding of how architecture and sustainability can be operationalized in diverse rural contexts. In conclusion, Ciambar District holds the potential to become a model of sustainable rural development where architecture transcends its conventional definition of buildings to encompass landscapes, infrastructures, and socio-economic systems. Through the integration of spatial design, ecological principles, and community empowerment, Ciambar could demonstrate a replicable framework for advancing rural resilience in Indonesia while contributing to global sustainability agendas. Sustainable economic development is an effort to improve the community's economic welfare without compromising the quality of the environment and available natural resources.

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Notes on contributors

Cut Sannas Saskia Cut Sannas Saskia is a lecturer at Universitas Trisakti specializing in sustainability and architecture. Her study focuses on improving green building performance by integrating theoretical insights with practical applications. She is actively involved in the project Market Accelerator for Green Construction (MAGC): EDGE Impact Evaluation in Indonesia. As a Green Professional certified by GBCI, she combines international standards with academic study and practice. Dedicated to shaping future professionals, she integrates cutting-edge sustainability study into her teaching, with a strong emphasis on environmentally responsible design in the built environment. She can be contacted at email: cutsannas@trisakti.ac.id

Etty R Krisdarso is a lecturer at Universitas Trisakti. A professional architect with more than three decades of experience, as well as an academic background. An expert in green building, settlement planning, sustainable buildings, and architectural design. Actively involved in various projects, research activities, and urban area development. Focused on innovative, functional, and sustainability-oriented design. email: etty.k@trisakti.ac.id

Ulfa Fatmasari Faisal is a faculty member in the Department of Civil Engineering at Universitas Trisakti, specializing in Construction Management. Her academic portfolio—spanning teaching, research, and community service—focuses on digital construction, sustainable building maintenance, urban resiliency, and construction safety. Beyond academia, she is a seasoned practitioner with extensive experience in national and regional construction projects. A Certified Construction Management Expert and Certified Safety Engineer, she remains an active contributor to professional associations and scientific forums at both national and international levels. Email: ulfa.fatmasari@trisakti.ac.id

Maria Immaculata Ririk Winandari Dr. Maria Immaculata Ririk Winandari is an associate professor at the Department of Architecture as well as Centre of Excellence Sustainable Cities and Environments member at Universitas Trisakti. She received her doctoral in architecture and planning and her research interest lies within the intersection of sustainable settlement, architecture, placemaking, green building, and heritage management. Ririk is associate editor for Journal of Urban and Environmental Technology, and she is a reviewer from more than 5 architectural and urban journals. She is active as expert member in ICOMOS CIVVIH and a professional member in Indonesian Architect Association. Email: mi.ririk@trisakti.ac.id

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Hanifa Fijriah

RUSTIC: Jurnal Arsitektur

Cut Sannas Saskia <cutsannas@trisakti.ac.id>
to Hanifa

Mon, Oct 13, 2025, 5:27 PM

Dear Rustic Editor,

Thank you for your feedback. I have revised the manuscript accordingly. The Results and Discussion section has been elaborated in more detail, the figures have been corrected, and the reference list now includes 18 references, including from the *Rustic Journal*. The Turnitin similarity report has also been added, should it be required.

Kind regards,

Cut Sannas Saskia

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Hanifa Fijriah

RUSTIC

Cut Sannas Saskia <cutsannas@trisakti.ac.id>
to Hanifa

Mon, Dec 29, 2025, 12:18 PM

Dear Ms. Hanifa Fijriah,
Editorial Team of RUSTIC: Jurnal Arsitektur,

Thank you for the notification regarding the discussion **"Author Metadata"** for our submission entitled **"Architecture and Sustainability Pathways for Rural Development in Indonesia"** (Submission ID: 3221).

We would like to inform you that the **revised manuscript has been submitted through the RUSTIC submission dashboard** in accordance with the reviewers' comments. The **author metadata has also been updated**, including the email addresses of all authors, as requested. We have **attached the revised manuscript file** to this email. The revision has been completed in accordance with the reviewer's comments, and we have **added summary tables** as requested to clearly present the problems, potentials, and proposed strategies discussed in the paper.

Please let us know if any further revisions or additional information are required.

Thank you for your kind assistance.

Kind regards,
Cut Sannas Saskia

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Architecture and Sustainability Pathways for Rural Development in Indonesia

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ABSTRACT

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Thu, Dec 18, 2025, 4:53 PM

Cut Sannas Saskia:

We have reached a decision regarding your submission to RUSTIC, "Architecture and Sustainability Pathways for Rural Development in Indonesia".

Our decision is: Revisions Required

Reviewer A:
Recommendation: Revisions Required

---

01. STRUCTURE

Good - The paper is well organized and easy to follow

01. STRUCTURE

Comments (if any)

The paper is easily to follow, but the text in the pictures are too small. It will be better if there's a table to summarize the problems and potency found in Ciambar and how to solve/expand them.

02. CONTENT

02. CONTENT

(D) Result & Conclusion

Fair - Discussion of the results is sufficient.

02. CONTENT

(E) Novelty

Fair - The writing contributes sufficient discussion towards the related area of research.

02. CONTENT

Comments (if any)

- The paper highlights interesting problem and potency found in Ciambar District but they're only skin deep
- The paper mentioned there are privately owned spring that cause problem to local community (lack of clean water access). It will be better if there's more analysis on the impact of private owned spring not only on the community but also the ecotourism for this area
- The paper acknowledge how effective participator approaches in developing rural communities, yet there's no mention and analysis of the people who lives in Ciambar district. Future study should also include a study about the local community.
- It'll be better if there's a table to summarize the problems, potential, and the reccomendation to expand Ciambar District

03. OVERALL EVALUATION

The paper is already good enough but please revise the text in the picture and include a table to summary all your points

04. FINAL DECISION

Accepted with Minor Revision

[RUSTIC] Editor Decision

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Tue, Dec 30, 2025, 12:28 PM

Cut Sannas Saskia:

We have reached a decision regarding your submission to RUSTIC, "Architecture and Sustainability Pathways for Rural Development in Indonesia".

Our decision is to: Accept Submission

RUSTIC

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Tue, Dec 30, 2025, 11:46 PM

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RUSTIC ITB Ahmad Dahlan

Wed, Dec 31, 2025, 12:12 AM

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4. If any, enter corrections (typographical and format) in Production discussion.

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Dear Editor,

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We have carefully reviewed the final PDF version as instructed through the Production stage. Please find attached the updated file, in which the *Notes on Contributors* section has been completed in full. Other than this addition, there are no further corrections to the manuscript.

We have also submitted the relevant note in the Production discussion as required.
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Kind regards,
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We have reached a decision regarding your submission to RUSTIC: Jurnal Arsitektur, " ARCHITECTURE AND SUSTAINABILITY PATHWAYS FOR RURAL DEVELOPMENT IN INDONESIA ".

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Please find the review results on your submission page. The author is required to submit their revision no later than **December 26th, 2025.**

Please kindly find the APC invoice and the copyright assignment in the attachment. The due date of the payment is December 29th, 2025. Please send the payment proof and the signed copyright assignment to rustic.ars.itb.ad@gmail.com. The Letter of Acceptance will be sent to you after the payment is made. Thank you.

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Thank you once again for the opportunity to publish our work in *RUSTIC: Jurnal Arsitektur*. We look forward to the next steps in the publication process.

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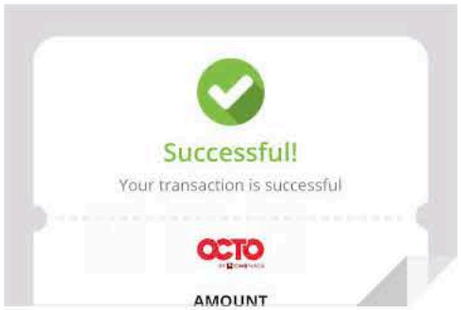

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Architecture and Sustainability Pathways for Rural Development in Indonesia

Cut Sannas Saskia[1*], Etty R Krisdarso[2], Ulfa Fatmasari Faisal[3], Maria Immaculata Ririk Winandari[4]
[1,2,4]Architecture Department, Faculty of Civil Engineering & Planning, Universitas Trisakti, DKI Jakarta, Indonesia
[3] Civil Engineering Department, Faculty of Civil Engineering & Planning, Universitas Trisakti, DKI Jakarta, Indonesia

Article Info

Article history:

Received: Oct 2, 2025
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ABSTRACT

Rural landscapes in Indonesia reflect the coexistence of strong agrarian traditions and the pressing need for sustainable development, requiring approaches that integrate ecological, spatial, and socio-economic systems. Ciambar District in Sukabumi Regency, West Java, serves as a representative case study, characterized by agricultural activities such as rice, cassava, and durian cultivation, extensive forest areas, and ecotourism potential, including Curug Luhur Waterfall. Despite these assets, the district faces persistent challenges, including inadequate infrastructure, unequal access to clean water, and heavy reliance on small-scale agriculture. From the perspective of architectural sustainability, Ciambar must be re-envisioned as an integrated landscape of productive, ecological, and social spaces. Approaches such as productive landscapes, ecological infrastructure, and low-impact ecotourism demonstrate how spatial and architectural interventions can simultaneously support livelihoods, conserve ecosystems, and enhance local resilience. This study aims to identify, analyze, and map the potentials of Ciambar District based on natural resources, human capital, and local governance capacity. The findings are expected to provide a comprehensive assessment of existing strengths and opportunities, along with strategic recommendations for sustainable environmental development that supports the local economy while aligning with broader sustainability frameworks.

Corresponding Author:

Cut Sannas Saskia
Architecture Department, Faculty of Civil Engineering & Planning, Universitas Trisakti, Kampus A, Jl. Kyai Tapa, Kota Jakarta Barat, Daerah Khusus Ibukota Jakarta 11440
Email: cutsannas@trisakti.ac.id

1. INTRODUCTION

Rural landscapes in Indonesia reflect both the persistence of traditional agrarian practices and the urgent need for sustainable development amid rapid socio-economic transitions. The concept of rural itself is tied to a low density area where the social hierarchy and roles, such as gender, religion, race, ethnicity, and class, which are often overlooked in rural development conversations [1]. Ciambar District, located in Sukabumi Regency, West Java, offers a critical case study in this discourse. Situated at an altitude of approximately 700 meters above sea level and covering 3,820 hectares, the district's spatial and socio-economic structure is dominated by rice fields, cassava and durian plantations, and extensive forest areas. These resources are complemented by ecotourism attractions such as Curug Luhur waterfall, which holds potential to diversify livelihoods through nature based tourism. Despite this wealth of resources, Ciambar faces persistent challenges

including infrastructure deficits, inequitable access to clean water, and economic dependency on small-scale agriculture. These issues situate Ciambar as a representative case of rural Indonesia, where natural endowments coexist with systemic vulnerabilities, thereby demanding an integrated approach that merges architectural landscape planning, sustainability frameworks, and socio-economic empowerment [2]. This study aims to identify, analyze, and map the potential of Ciambar District, based on natural resources, human resources, and the authority of the local government. The study is expected to provide a comprehensive discussion of existing strengths and opportunities, as well as deliver targeted recommendations for sustainable environmental development that will enhance the economic sector.

Several aspects will be the focus of this study, including agricultural potential, plantation potential, tourism potential, creative industry potential, and human resource potential that can support regional development. The local government uses local economic development to discover and capitalize on the region's potential, increasing community welfare while promoting regional growth, particularly in rural areas that are mostly dominated by agricultural operations [3]. Through a holistic and data-driven approach, particularly using secondary data, this study is expected to make a tangible contribution to the local government and other stakeholders in formulating policies and development strategies for Sukabumi Regency.

In rural settings, architecture extends beyond the construction of buildings to encompass landscapes, infrastructures, and spatial systems that mediate interactions between people and the environment. Sustainable architectural discourse emphasizes ecological sensitivity, adaptive design, and socio-economic resilience as interdependent components of development [2]. This study adopts that perspective, positing that Ciambar's future development hinges on reconceptualizing its agricultural, ecological, and social spaces as interconnected systems. Such integration is particularly salient as agriculture remains the backbone of the local economy, yet diversification into ecotourism and small-scale industries has become increasingly essential to strengthen livelihoods. The adaptive capacity of local communities is both distinctive and multifaceted, serving as a bridge between conservation efforts and the sustainable utilization of ecosystem services. Spatial design can be used to mediate buildings and communities, as it facilitates community involvement and a feeling of belonging [4]. When communities are actively engaged in co-management and co-production processes, their participation strengthens socio-ecological resilience, thereby supporting the long-term availability of resources for ecotourism as well as food systems and agroecosystems. In creative placemaking, community participation is often regarded as a mandatory tool in changing community perception towards the development of a place [5]. Moreover, socio-ecological resilience plays a pivotal role in ensuring the sustainability of ecotourism [6].
The global policy framework of the United Nations' Sustainable Development Goals (SDGs) provides an analytical lens for situating Ciambar's developmental trajectory. Among the 17 SDGs, three are especially relevant to Ciambar: SDG 8 on decent work and economic growth, SDG 11 on sustainable cities and communities, and SDG 13 on climate action. Aligning local strategies with these global targets ensures that Ciambar's development contributes not only to regional prosperity but also to broader sustainability agendas [7], [8]. Against this backdrop, the objective of this study is to identify, analyze, and map the district's potentials and challenges through the lens of architecture and sustainability, while formulating recommendations that reinforce local strengths and address existing gaps.

The relationship between architecture and sustainability has been the subject of considerable scholarly debate over the last two decades. Sustainable architecture is increasingly defined not only by its technical efficiency but also by its ability to embed ecological and socio-economic resilience within spatial systems [2]. Sustainable architectural principles are applied to the development of an urban area, which automatically fulfills the needs of creating a healthy city [9]. Scholars emphasize that sustainability in rural settings requires integrating ecological design principles into landscapes, infrastructure, and settlements, thereby producing spatial configurations that are adaptive and regenerative rather than extractive [10], [11].

Architecture in rural contexts often functions at the scale of landscapes rather than isolated buildings. Productive landscapes agricultural spaces that combine food production, ecological services, and social uses are considered central to sustainable rural development [12]. These landscapes align with the idea of multifunctionality, where agriculture contributes simultaneously to livelihoods, biodiversity conservation, and cultural identity. Furthermore, architectural approaches to rural infrastructure increasingly emphasize "green infrastructure," defined as interconnected networks of natural and semi-natural systems that deliver ecosystem services while supporting human needs [8].

Rural development literature highlights the necessity of embedding sustainability principles in economic diversification, community participation, and environmental management [13]. In Indonesia, rural economies remain predominantly agricultural, but the volatility of commodity markets and environmental degradation pose risks to long-term viability. Diversification into ecotourism and small-scale enterprises has been identified as a critical pathway to enhance resilience [14], provided that such strategies are anchored in community empowerment and ecological conservation.

Participatory approaches have been increasingly acknowledged in both sustainability science and architectural practice as essential for ensuring the legitimacy and effectiveness of interventions [11]. Studies demonstrate that rural communities are more likely to embrace sustainability initiatives when they are involved in the design, planning, and management of spaces [15]. For Ciambar, integrating participatory mapping with architectural landscape analysis provides an avenue for reconciling top-down planning with bottom-up knowledge, creating outcomes that are both spatially coherent and socially relevant.

The SDGs serve as a unifying framework for linking local rural development with global sustainability objectives. Empirical studies in Southeast Asia show that aligning rural development strategies with SDG targets can enhance resilience, particularly when interventions address employment, infrastructure, and ecological conservation in tandem [13]. In the context of Ciambar, this alignment underscores the potential of architecture and sustainability approaches to serve as mediating frameworks between global policy and local realities.

2. METHOD

This study employed a descriptive-analytical study design that integrates spatial observation, participatory mapping, and secondary data analysis. The rationale for using a descriptive analytical approach lies in its ability to synthesize empirical field observations with theoretical frameworks of architecture and sustainability, thereby producing a holistic understanding of Ciambar's potentials and constraints. Fieldwork was conducted across key sectors of Ciambar's landscape, including agricultural fields, plantation areas, forest ecosystems, ecotourism sites, and community infrastructure. Observational data were systematically recorded with respect to land-use patterns, the physical condition of built and natural environments, and infrastructural systems such as road connectivity, water distribution networks, sanitation, and public facilities. This approach is consistent with established practices in landscape architecture study, where spatial analysis is grounded in empirical field data [10].

A participatory mapping component was incorporated to ensure the inclusion of local knowledge and aspirations. Participatory mapping in rural areas, especially done by locals, provides a more relevant data that will in turn be a more contextual and usable resource [16]. This was operationalized through focus group discussions with residents, interviews with community leaders, and consultations with district officials. Participatory approaches are increasingly emphasized in sustainable architecture and planning as they facilitate shared ownership and enhance the cultural legitimacy of proposed designs [11]. Data triangulation was achieved by comparing field observations, spatial analysis, and stakeholder narratives, thereby strengthening the validity of findings.

3. RESULTS AND DISCUSSION

The analysis revealed that Ciambar District embodies both significant potentials and structural challenges, positioning it as a landscape of opportunities constrained by systemic limitations.

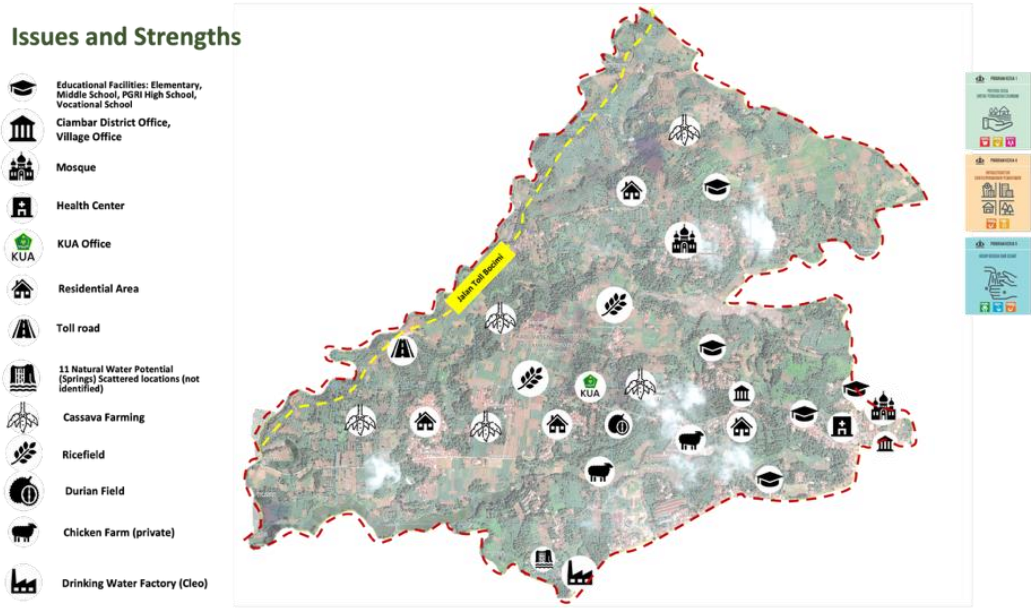

Figure 1. Mapping Strengths and Issues in Ciambar District

Agriculture emerged as the dominant sector, with rice, cassava, and durian plantations forming the foundation of household livelihoods. Cassava, in particular, plays a strategic role in the local economy, not only as a subsistence crop but also as a raw material for micro, small, and medium enterprises (MSMEs). Products such as modified cassava flour (mocaf), kecimpring, and opak are increasingly integrated into local value chains. However, the growth of these enterprises is constrained by inadequate access to hygienic production spaces, limited financial capital, and insufficient capacity in digital marketing platforms. Similar patterns of constrained agribusiness development have been observed across rural Indonesia, where infrastructural deficits undermine the potential of agricultural value chains.

The presence of Curug Luhur waterfall and surrounding forest ecosystems represents a strong potential for ecotourism. The area's natural assets could be developed through eco-architectural interventions such as environmentally sensitive trails, community-managed visitor facilities, and interpretive signage. Empirical studies from other Indonesian regions demonstrate that ecotourism, when coupled with ecological architecture, can enhance rural livelihoods while safeguarding biodiversity. Nonetheless, infrastructural barriers such as poor road conditions and the lack of accommodation facilities limit the viability of expanding ecotourism. Without careful spatial planning, there is also a risk that tourism development could exacerbate ecological degradation rather than contribute to sustainability [8].

Ciambar possesses 11 natural springs that could potentially provide sustainable sources of water for households and agricultural irrigation. However, several of these springs are under private control, resulting in inequitable distribution. Approximately 20 households were documented as lacking access to clean water, while 90 households continue to rely on communal sanitation facilities. These deficiencies compromise public health and hinder the growth of MSMEs that depend on hygienic processing environments. Studies have shown that inadequate access to water and sanitation is a persistent constraint on rural development across Southeast Asia [13].

Infrastructure, which in rural Indonesia has not experienced significant development in the last 20 years [17], emerged as the most significant limiting factor. Many inter-village road connections remain unpaved, restricting the mobility of residents and the transportation of agricultural products. This infrastructural weakness not only reduces market accessibility but also hampers the district's ability to attract tourists. Similarly, access to basic services such as healthcare and education remains uneven, further constraining socio-economic mobility. These findings align with broader studies indicating that infrastructural deficits are among the most critical barriers to sustainable rural development.

The findings of this study highlight the importance of reimagining Ciambar District through the lens of architecture and sustainability. In architectural terms, the district is not merely a collection of agricultural fields, forests, and settlements, but rather a dynamic landscape of interconnected productive, ecological, and social spaces. Sustainable architecture provides a framework to design and manage these relationships so that they enhance both resilience and functionality [2], [10].

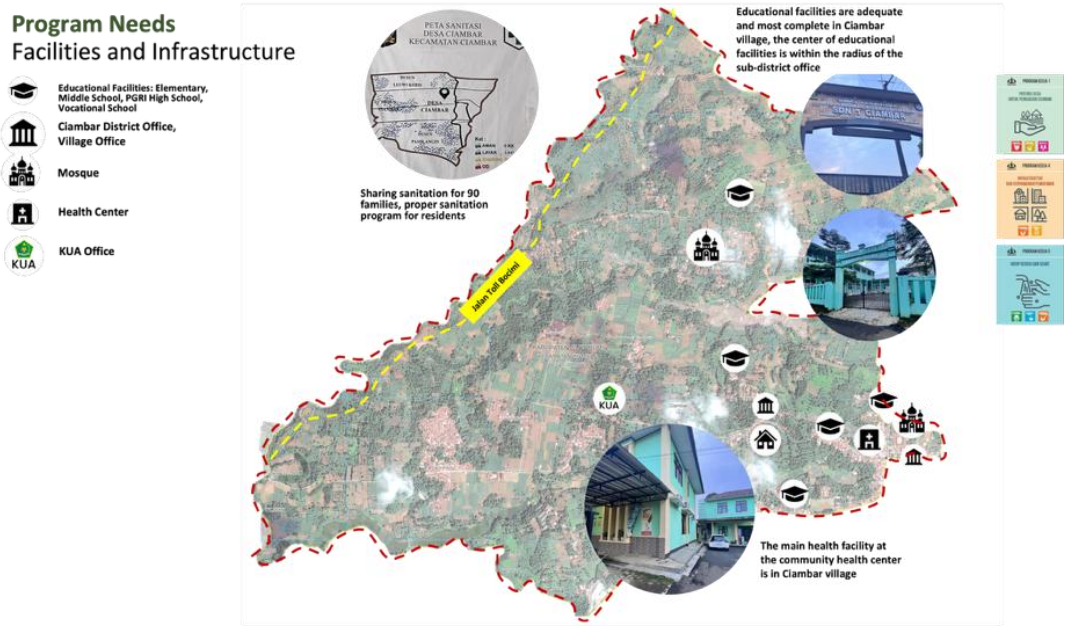

Figure 2. Program Needs in Ciambar District

One of the central arguments in the discourse of sustainable architecture is the notion of productive landscapes, that perform multiple ecological, economic, and social functions simultaneously [12]. For Ciambar, this means that cassava and durian plantations should not be regarded only as economic assets but also as potential educational and tourism spaces. Farm based education programs could introduce principles of agroecology to schoolchildren, while architectural interventions such as multi-purpose pavilions could integrate food processing, community gatherings, and visitor experiences. This multifunctional approach aligns with global calls to integrate food systems, ecological services, and social infrastructures in rural design [18].

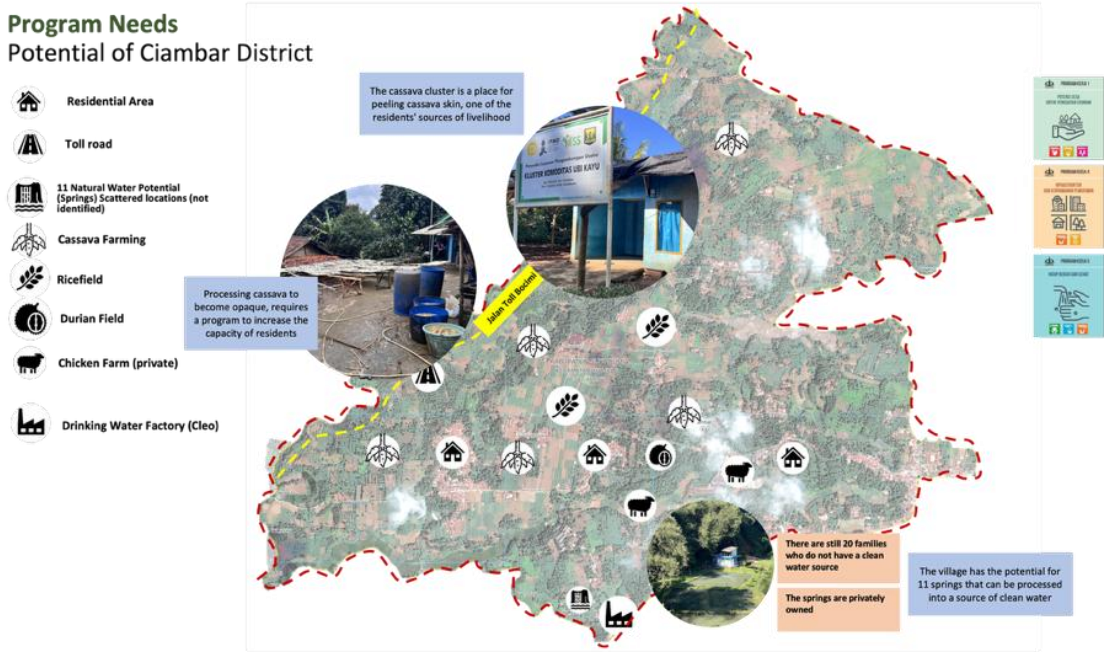

Figure 3. Mapping Strengths based on Program Needs in Ciambar District

Ecotourism development in Ciambar, particularly around Curug Luhur, illustrates the potential of ecological architecture. By adopting low impact design strategies such as elevated walkways, local material construction, and renewable energy integration, visitor facilities could blend with the natural landscape while minimizing environmental degradation. Study on community based ecotourism in Bali and other parts of Indonesia demonstrates that such architectural approaches can yield significant socio-economic benefits without compromising ecological integrity. Importantly, community participation in both design and management must be emphasized, since ecotourism that marginalizes local stakeholders often results in inequitable outcomes [11].

Infrastructure deficiencies in Ciambar must also be reframed through the perspective of green infrastructure. Rather than treating infrastructure as purely technical systems, sustainable design approaches emphasize its multifunctionality. Roads, for instance, could be designed as ecological corridors that integrate drainage channels, green strips, and pedestrian pathways. This is consistent with contemporary scholarship that frames green infrastructure as a means to enhance resilience, biodiversity, and human well-being simultaneously [8]. For Ciambar, such a reorientation could address mobility constraints while strengthening ecological connectivity.

Table 1. Summary of Spatial Issues, Potentials, and Development Needs in Ciambar District

Sector	Key Issues	Existing Strengths / Potentials	Identified Program Needs
Livelihood and Local Economy	Cassava processing remains traditional with low added value and limited production capacity among residents.	A cassava commodity cluster exists and serves as one of the main sources of livelihood for the community.	Capacity-building programs are needed to improve cassava processing techniques and develop value-added agro-industrial products.

Water Resources and Clean Water Access	Around 20 households do not have access to clean water due to limited communal infrastructure and private ownership of springs.	The village possesses 11 natural springs with strong potential to be developed as clean water sources.	Community-based clean water infrastructure and shared water resource management systems are required.
Sanitation	Approximately 90 households still rely on shared sanitation facilities.	Basic sanitation infrastructure is already available in several parts of the village.	Household-scale sanitation improvement and hygiene awareness programs are necessary.
Education Facilities	Educational facilities are unevenly distributed across the district.	Ciambar Village functions as the educational center with relatively complete facilities within the sub-district service radius.	Improved accessibility and supporting facilities are needed for residents in peripheral areas.
Health Facilities	Health services are concentrated in the village center, limiting access for outer areas.	The main community health center is located in Ciambar Village.	Expansion of health service coverage and improvement of supporting health infrastructure are required.
Infrastructure and Accessibility	Local road connectivity remains limited in certain areas.	The district benefits from strategic access through the Bocimi Toll Road.	Enhancement of local road networks is needed to support mobility and economic activities.
Institutional and Public Facilities	Public services remain centralized and require travel from remote settlements.	Key public and religious institutions are already established within the district.	Decentralization and strengthening of village-level public services are needed.
Agriculture and Natural Resources	Agricultural activities are dominated by primary production with limited diversification.	Fertile agricultural land and strong farming traditions characterize the district.	Sustainable agriculture and diversification programs are required to increase resilience and productivity.
Settlement and Housing	Housing quality varies across different settlement areas.	Rural settlement patterns show strong social cohesion and community structure.	Integrated housing improvement programs linked with sanitation and clean water provision are needed.

The role of architecture in supporting MSMEs also deserves emphasis. The design and provision of shared hygienic processing spaces could dramatically improve the quality and competitiveness of local products. These facilities should integrate ecological principles such as natural ventilation, energy efficiency, and modular adaptability. Architectural studies in Southeast Asia have shown that such catalytic spaces not only enhance production capacity but also foster social interaction and innovation within communities. By linking physical spaces with socio economic empowerment, architecture becomes a driver of local development.

The integration of Ciambar's potentials and challenges with the Sustainable Development Goals (SDGs) underscores the global relevance of local action. Efforts to diversify agriculture and strengthen MSMEs directly contribute to SDG 8 on decent work and economic growth. The reorganization of village spaces through ecological architecture supports SDG 11 on sustainable cities and communities. Conservation of forest and water resources, together with low-carbon tourism development, advances SDG 13 on climate action. This reinforces the argument that architecture and sustainability must be viewed as systemic interventions that bridge the local and global scales of development [13].

4. CONCLUSION

Ciambar District epitomizes the paradox of rural Indonesia: rich in natural and cultural resources but constrained by infrastructural and socio-economic vulnerabilities. This study has demonstrated that an architectural and sustainability perspective provides a valuable framework for reimagining the district's

development trajectory. By treating agricultural areas as multifunctional productive landscapes, developing ecotourism with ecological sensitivity, and rethinking infrastructure as green corridors, Ciambar can transition toward a sustainable rural model. The empowerment of MSMEs through architecturally designed shared facilities further highlights the intersection between space, economy, and society. Such interventions not only improve economic outcomes but also foster social cohesion and innovation, reinforcing the role of architecture as both a spatial and socio-economic catalyst.

The implications of this study extend in two directions. At the practical level, it offers spatially grounded strategies for policymakers and local communities, emphasizing the integration of ecological design, community participation, and sustainability principles. At the academic level, it contributes to the discourse on rural architecture and sustainable development by demonstrating how spatial analysis and participatory methods can inform transformative pathways in resource-rich but infrastructure-poor regions. Future study could expand this study through quantitative assessments of environmental impacts, exploration of financing mechanisms for sustainable infrastructure, and comparative analysis with other rural districts in Indonesia and Southeast Asia. Such work would deepen the understanding of how architecture and sustainability can be operationalized in diverse rural contexts. In conclusion, Ciambar District holds the potential to become a model of sustainable rural development where architecture transcends its conventional definition of buildings to encompass landscapes, infrastructures, and socio-economic systems. Through the integration of spatial design, ecological principles, and community empowerment, Ciambar could demonstrate a replicable framework for advancing rural resilience in Indonesia while contributing to global sustainability agendas. Sustainable economic development is an effort to improve the community's economic welfare without compromising the quality of the environment and available natural resources.

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Notes on contributors

Cut Sannas Saskia Cut Sannas Saskia is a lecturer at Universitas Trisakti specializing in sustainability and architecture. Her study focuses on improving green building performance by integrating theoretical insights with practical applications. She is actively involved in the project Market Accelerator for Green Construction (MAGC): EDGE Impact Evaluation in Indonesia. As a Green Professional certified by GBCI, she combines international standards with academic study and practice. Dedicated to shaping future professionals, she integrates cutting-edge sustainability study into her teaching, with a strong emphasis on environmentally responsible design in the built environment. She can be contacted at email: cutsannas@trisakti.ac.id

Etty R Krisdarso is a lecturer at Universitas Trisakti. A professional architect with more than three decades of experience, as well as an academic background. An expert in green building, settlement planning, sustainable buildings, and architectural design. Actively involved in various projects, research activities, and urban area development. Focused on innovative, functional, and sustainability-oriented design. email: etty.k@trisakti.ac.id

Ulfa Fatmasari Faisal is a faculty member in the Department of Civil Engineering at Universitas Trisakti, specializing in Construction Management. Her academic portfolio—spanning teaching, research, and community service—focuses on digital construction, sustainable building maintenance, urban resiliency, and construction safety. Beyond academia, she is a seasoned practitioner with extensive experience in national and regional construction projects. A Certified Construction Management Expert and Certified Safety Engineer, she remains an active contributor to professional associations and scientific forums at both national and international levels. Email: ulfa.fatmasari@trisakti.ac.id

Maria Immaculata Ririk Winandari Dr. Maria Immaculata Ririk Winandari is an associate professor at the Department of Architecture as well as Centre of Excellence Sustainable Cities and Environments member at Universitas Trisakti. She received her doctoral in architecture and planning and her research interest lies within the intersection of sustainable settlement, architecture, placemaking, green building, and heritage management. Ririk is associate editor for Journal of Urban and Environmental Technology, and she is a reviewer from more than 5 architectural and urban journals. She is active as expert member in ICOMOS CIVVIH and a professional member in Indonesian Architect Association. Email: mi.ririk@trisakti.ac.id