

# Sustainable Development of Tay Ethnic Village Spaces in Tuyen Quang Province Through the Preservation and Utilization of Traditional Architectural Values

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## Abstract

This study investigates the sustainable development of Tay ethnic village spaces in Tuyen Quang province, Vietnam, through the preservation and use of traditional architectural values. Indigenous architectural techniques - formed over many generations to adapt to natural, cultural and social conditions - are rapidly being lost due to urbanization, livelihood transformation and changing development pressures. The study used a multi-method approach, including literature review, field survey, expert consultation and community interviews, with a methodology emphasizing "community-based planning" to assess the current status of traditional architecture and community needs. Focusing on Tan Lap village in Tan Trao commune, the study identified the main architectural features, spatial configurations and socio-cultural functions of Tay stilt houses. Based on these findings, the study proposes sustainable spatial planning strategies that integrate traditional values with contemporary needs to support cultural preservation, community-based tourism and sustainable rural development. This study contributes to ongoing efforts to protect ethnic heritage while promoting inclusive and adaptive rural planning.

## 1. Introduction

### 1.1 Research Context

The Northern mountainous region of Vietnam, comprising the Northwest and Northeast areas, borders China to the north, Laos to the west, the Red River Delta and North Central Coast to the south, and the Gulf of Tonkin to the east. This region encompasses 11 provinces—Ha Giang, Cao Bang, Bac Kan, Tuyen Quang, Lang Son, Lao Cai, Yen Bai, Dien Bien, Lai Chau, Son La, and Hoa Binh—and holds significant potential for economic development and cultural tourism. It is home to 29 ethnic minority groups, including the H'mong, Tay, Dao, Giay, Lo Lo, and others, each contributing to the region's rich cultural tapestry [1].

In recent decades, however, many ethnic minority communities in this region have been increasingly impacted by urbanization and the tension between development pressures and the preservation of traditional cultural values. Rapid economic change has altered the physical and cultural landscapes of villages and hamlets, eroding traditional ways of life. For communities whose livelihoods are closely tied to natural systems, such as the ethnic minorities in this region, these transformations pose significant challenges to maintaining sustainable village development and preserving their architectural and cultural heritage [2].

## 1.2 Research Rationale

Tuyen Quang, a northern mountainous province of Vietnam, is home to 22 ethnic minority groups, with the Tay ethnic group being the largest after the Kinh people [3]. These communities typically reside in cohesive village clusters, where familial and communal bonds are strong and traditional customs are deeply rooted [4].

Renowned for its diverse tangible and intangible heritage, Tuyen Quang is recognized as a land of cultural convergence. Traditional mountain villages in the province are living testimonies of human adaptation to natural conditions—embodying generations of indigenous wisdom, architectural ingenuity, and cultural identity. Yet, these values are increasingly overlooked, particularly in Tay ethnic villages near expanding urban centers, where urbanization accelerates the erosion of cultural heritage [4, 5].

From an ethnopsychological viewpoint, traditional villages serve not only as places of residence and production but also as vital spaces for knowledge transmission, intergenerational learning, and cultural continuity [6]. Therefore, efforts to sustainably develop ethnic village spaces must prioritize preserving these traditional values and cultural identities—integrating them meaningfully into the planning and development process rather than allowing them to be lost in modernization.

## 1.3 Research Objectives

This research study aims to:

- Assess the needs of the Tay ethnic community in Tuyen Quang regarding the sustainable development of their village spaces based on traditional architectural values;
- Identify and analyze the architectural features and spatial functions of Tay ethnic settlements—particularly in Tan Lap Village, Tan Trao Commune, Son Duong District—that support cultural preservation and sustainable rural development;
- Propose planning and design solutions that integrate traditional architectural values with modern development needs to enhance the sustainability and resilience of Tay ethnic villages.

## 1.4 The Structure of the Paper

The remainder of this paper is organized as follows:

- Section 2 presents a review of relevant literature on sustainable development, traditional village architecture, and indigenous knowledge, with a focus on their applications in mountainous and ethnic minority regions.
- Section 3 outlines the research methodology, detailing the multi-phase approach that includes literature analysis, field surveys, expert consultations, and community interviews.
- Section 4 introduces the theoretical framework, explaining key concepts such as village space, sustainable development criteria, and traditional architectural values, while discussing their interrelations within the context of ethnic village planning.
- Section 5 examines the spatial, cultural, and architectural characteristics of Tay ethnic villages in Tuyen Quang Province, with emphasis on traditional values and spatial organization.
- Section 6 presents the results of the study, including expert evaluations, community needs assessments, spatial analysis, and a detailed case study of Tan Lap Village. It also includes discussion and proposals for sustainable development strategies.
- Section 7 concludes the paper with a summary of key findings, practical recommendations, research limitations, and future research directions aimed at enhancing the preservation and sustainable development of ethnic village spaces.

## 2. Literature Review

Social and economic changes, climate change, urban population growth, and shifts in agricultural supply chains have all impacted land use and led to conflicts between urban and rural development [7-9]. Currently, sustainable development is an urgent need for both urban and rural areas - especially for mountainous villages, where natural landscapes are prominent and where the conflict between humans and nature is most evident [10]. Therefore, in

mountainous areas, it is necessary to implement measures to protect and promote the sustainable use of natural ecosystems, such as forest management, the promotion of sustainable agriculture, and the transformation of mountain villages into safe, adaptable, and sustainable places. The goal is to achieve harmony and shared prosperity between people and the natural environment.

In his book *Design with Nature*, McHarg studied ecological planning to coordinate the relationship between humans and nature within a development area [11, 12]. More recently, among various perspectives on achieving harmony between humans and the land, some scholars believe that controlling consumption and development can help regions attain ecological sustainability, social equity, and cultural revitalization [13, 14]. Villages in harsh environments offer deeper insights into the characteristics of sustainable development [15].

As understanding of ecosystems deepens, many scholars have discovered that traditional knowledge is closely linked to fundamental assumptions of sustainability and can serve as a crucial guide for modern sustainability research. They advocate for the integration of traditional indigenous knowledge into conservation and ecological restoration planning [16, 17]. Cai analyzed the characteristics of Dong ethnic settlements in terms of architectural forms, spatial layout, and ethnic culture, based on survey data from several villages, and proposed the concept of "architectural cultural zones", areas where the built environment reflects a distinct cultural identity, influenced by the unique customs, traditions, and values of the people who inhabit it, based on the theory of living heritage. Therefore, integrating perspectives and methods from geography, architecture, and anthropology is essential as a foundational orientation for proposing sustainable development strategies for village spaces that draw on traditional architectural values [17].

Factors affecting sustainable development are very diverse, including culture, society, organisations, and social interactions [18]. Architecture aligned with lifestyle trends and modern technologies contributes to a sustainable environment. Adaptation is the relationship between human actions and environmental responses, including how to preserve the environment to absorb the results of those actions [19, 20]. Architecture is the total relationship between human and world view expressed in two perspectives: material (between "human" and "nature") and immaterial (expressing ideologies or metaphysical forms) [21]. Therefore, it is necessary to learn from past adaptation experiences to bring them into the present, to understand the processes and grasp the causes of change (state, economy, and society - community) [22, 23].

### 3. Research Design and Methods

The study employed a mixed-methods approach conducted in four key phases:

- Literature Review: Relevant domestic and international research on ethnic village spaces, traditional Tay housing architecture, and sustainable development theories were collected, synthesized, and analyzed.
- Field Surveys: The team conducted on-site observations, measurements, photography, and documentation to capture the spatial and architectural characteristics of Tay stilt houses and village layouts.
- Expert Consultation: Feedback from local experts was gathered to evaluate the relevance and importance of various sustainability criteria for ethnic village development.
- Community Interviews: Interviews with local residents provided insights into the community's awareness, aspirations, and expectations regarding the preservation and sustainable development of their living spaces.
- Data Synthesis: Findings were thematically analyzed and structured into case studies, leading to the formulation of practical recommendations for sustainable village development grounded in traditional architectural values.

## 4. Theoretical Framework

### 4.1. Key Concepts and Definitions

Village Space [2]: Small residential clusters where communities live and conduct production, often located along mountainsides, rivers, or flat valleys. Village spaces are characterized by strong social relationships and include physical space, social space, and the cultural and economic space of the community.

Sustainable Development of Village Space: Based on the three pillars of sustainable development, this approach must meet the following criteria:

- Sustainable economic growth: Rural residential spaces are often associated with agricultural economic activities.
- Social equity and increased community participation: This includes improving the quality of the living environment, ensuring adequate living conditions, and modernizing rural areas for the benefit of the community.
- Environmental protection and preservation for the future: This involves saving energy, ensuring clean water and natural environments, adapting to climate change, and inheriting and promoting traditional values.

**Traditional Architectural Values:** These are the accumulated wisdom of traditional construction practices — unique outcomes of the harmonious integration between nature, culture, and people. They represent the results of human adaptation to and transformation of the natural environment [24].

## 4.2. Sustainable Development

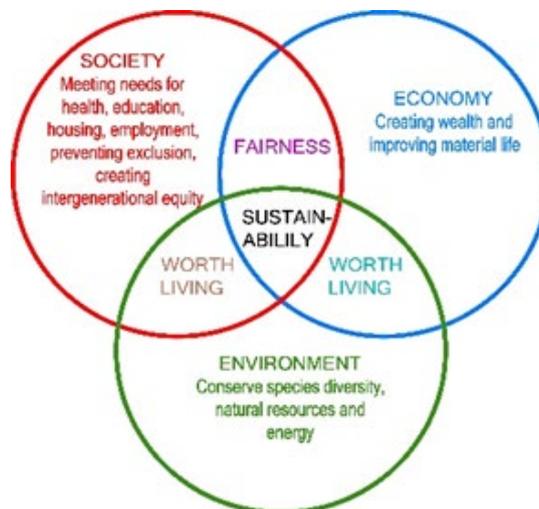
Sustainability is the ability to maintain development over a long period of time, meeting the needs of the present without compromising the needs of the future [25].

Sustainable architecture is the optimal outcome of the philosophy of sustainable design, expressed consistently through the design methodology, the design solutions, and the decisions made during the construction process, operation, use, and potential reuse after the building has fulfilled its original purpose [26].

To ensure sustainability, architecture must meet criteria related to the location, use of energy resources, environmental quality of the building, cultural identity, and long-term socio-humanistic values.

From the perspective of sustainable development, sustainable architecture must simultaneously address the three aspects of environment, economy, and society. It should maximize both direct and indirect economic efficiency; respond to developmental demands, renewal, and preservation of cultural characteristics of the site where the building is constructed.

In the process of social development, as material values approach human satisfaction, cultural and spiritual values become the foundational values and driving forces of development. Moreover, the carrying capacity and adaptability of the site are prerequisites for balanced and sustainable development.



**Fig. 1** Framework for sustainable development [25]

## 4.3. Spatial Organization Theory of Ethnic Villages

Sustainable development through ecosystem stabilization, as exemplified by Dong villages in the Duliujian River Basin in southeastern Guizhou, demonstrates that the impact of mountainous agricultural livelihood models—adapted to diverse topographical and hydrological conditions—has led to the formation of various spatial village structures, such as: valley–river–mountain–hillside; or mountain–river–forest–rice fields–village [7], and so on. Their management mechanism involves the use of limited natural resources, which nevertheless plays a vital role in governance and supervision. The natural foundation of “Mountains–Water–Forests–Fields–Rice” aligns with the livelihood model and socio-cultural practices, creating a unique ecosystem that has become the essential environment for the community’s survival—and which still holds significant value to this day. Mountain villages have developed under harsh living conditions and are now facing further challenges such as limited agricultural land, increasing pressure on water resources, and frequent natural disasters [27]]. Current research on the spatial sustainability of mountainous villages needs to focus on sustainable livelihoods [28], as sustainable livelihoods are those that can respond to and recover from challenges, while maintaining or even enhancing the community’s capacity and assets in both the present and the future—without depleting natural resources [29]. To achieve sustainable development in northern mountainous villages, it is essential to consider local geographical, climatic, and economic factors in a comprehensive manner. In particular, sustainable spatial development of these villages—through the integration of traditional values within the current context—must strike a balance: on one hand, benefiting from socio-economic development programs, and on the other, preserving cultural identity and aligning with the local development orientation.

## 5. Space of Tay Ethnic Villages in Tuyen Quang Province

### 5.1. Traditional Cultural Values of the Tay Ethnic Group

It is the natural blessings and deep historical roots that have made Tuyen Quang a land where multiple cultural colors converge [30]. Through their labor and way of life, the Tay ethnic community in Tuyen Quang has developed a rich and distinctive treasure trove of both tangible and intangible cultural heritage. Their language belongs to the Tay-Thai language group. Seasonal festivals feature ceremonial practices such as the "Then" ritual of the Tay-Nung-Thai peoples of Vietnam, which has been recognized by UNESCO. The Tay people possess unique musical instruments that express cultural identity and a high level of musical sophistication, capable of conveying deep emotion—such as the Tinh lute and traditional percussion instruments. In terms of cuisine, the Tay people are known for their rustic dishes like bamboo-tube rice (*com lam*) and ant egg cake (*banh trung kien*). The clothing of the Tay is simple and modest, with a graceful elegance, dominated by indigo blue and black. A highlight of traditional Tay dress is its decorative elements, such as sashes, earrings, and necklaces. The Tan Trao historical site in Tuyen Quang is home to many rare medicinal plants. Additionally, the Tay people preserve a rich oral tradition through folk tales, proverbs, and idioms that convey knowledge about farming, life philosophy, and interpersonal conduct. Tuyen Quang is home to around 12 religions, among which the Tay people primarily follow Taoism, Confucianism, and Buddhism.



**Fig. 2** (a) Special food trays; (b) Brocade weaving (c) Long Tong festival (d) Traditional wedding  
Source: [5]

### 5.2. Traditional Architectural Values of Tay Villages

Through the process of conquering nature, the ethnic communities in Tuyen Quang have created terraced landscapes on mountain slopes, transforming wild, barren land into prosperous settlements with fields, rice paddies, ponds, and lakes for cultivation and livestock farming. Tay ethnic villages are typically located on hillsides or low mountain slopes near streams. Each village usually consists of 10 to 15 households living together, though more populated villages can have up to 50 or 60 households. Guided by the belief that settling down must come before economic development, the Tay people place great importance on choosing the right location to establish a village. The chosen area must be elevated to avoid flooding during the rainy season, close to streams for easy access to water for daily use and farming, near fields to facilitate rice cultivation, and adjacent to forests for easy access to forest resources.



**Fig. 3** Structure of some Tay ethnic villages in Lam Binh district, Tuyen Quang (a) Na Lau village, Thuong Lam commune; (b) Tay people's stilt house in Lam Binh village; (c) Na Lung village, Thuong Lam commune

The spatial structure of traditional Tay villages generally takes two main forms:

- Clustered or point form: densely populated villages located in flat terrain, near streams, at the foot of hills or mountains.
- Ring or linear form: villages that stretch along hillsides or mountain slopes, with pathways leading into alleys and homes

Tuyen Quang is also a place that still preserves many ancient architectural works, including the Bao Ninh Sung Phuc stele, which has been recognized as a national treasure, and many nationally ranked historical sites such as Tuyen Quang Citadel, Ha Temple, among others. Notably, there are three special national relic zones, including:

- The Special National Historical Site of Tan Trao (Son Duong)
- The Special National Historical Site of Kim Binh (Chiem Hoa).
- The Special National Scenic and Historical Site of the Na Hang-Lam Binh Nature Reserve

**Residential architecture:** The Tay stilt houses in Tuyen Quang are characterized by their distinctive architectural style, reflecting harmony between humans, nature, and culture. They embody cosmological views, perceptions of nature and humanity, and the customs and philosophies of everyday life.

- Spiritual-functional value: The house carries strong elements of spiritual belief, shaped by agricultural cultural influences.
- Socio-cultural functional value: The home serves as a gathering space, a place for social interaction and cultural performances, closely tied to everyday life.
- Economic functional value: The house compound includes fences and a garden yard. Homes are typically built with their backs against the mountain and face streams and rice fields.

Architectural characteristics:

- Orientation: Houses typically face streams, valleys, and are oriented south or southeast.
- Architectural layout: Usually built with 3 to 5 compartments (*gian*) and two side wings (*cha'i*), which are used for production or storage.
- Roof style: A four-sided roof structure is common, covered with leaf thatch or red tiles.
- Stilt house design: Often includes a small bamboo platform outside the veranda used for drying clothes or agricultural products.
- A small number of homes are ground-level houses.
- Structural framework: The truss system in Tay houses follows a similar pattern, differing only in size to fit different types of homes. A distinct feature is that only wooden joints are used to connect beams and columns-iron nails are not used.

During the course of development, the structure of Tay stilt houses has intermingled with the architectural elements of other ethnic groups, especially the Kinh people.

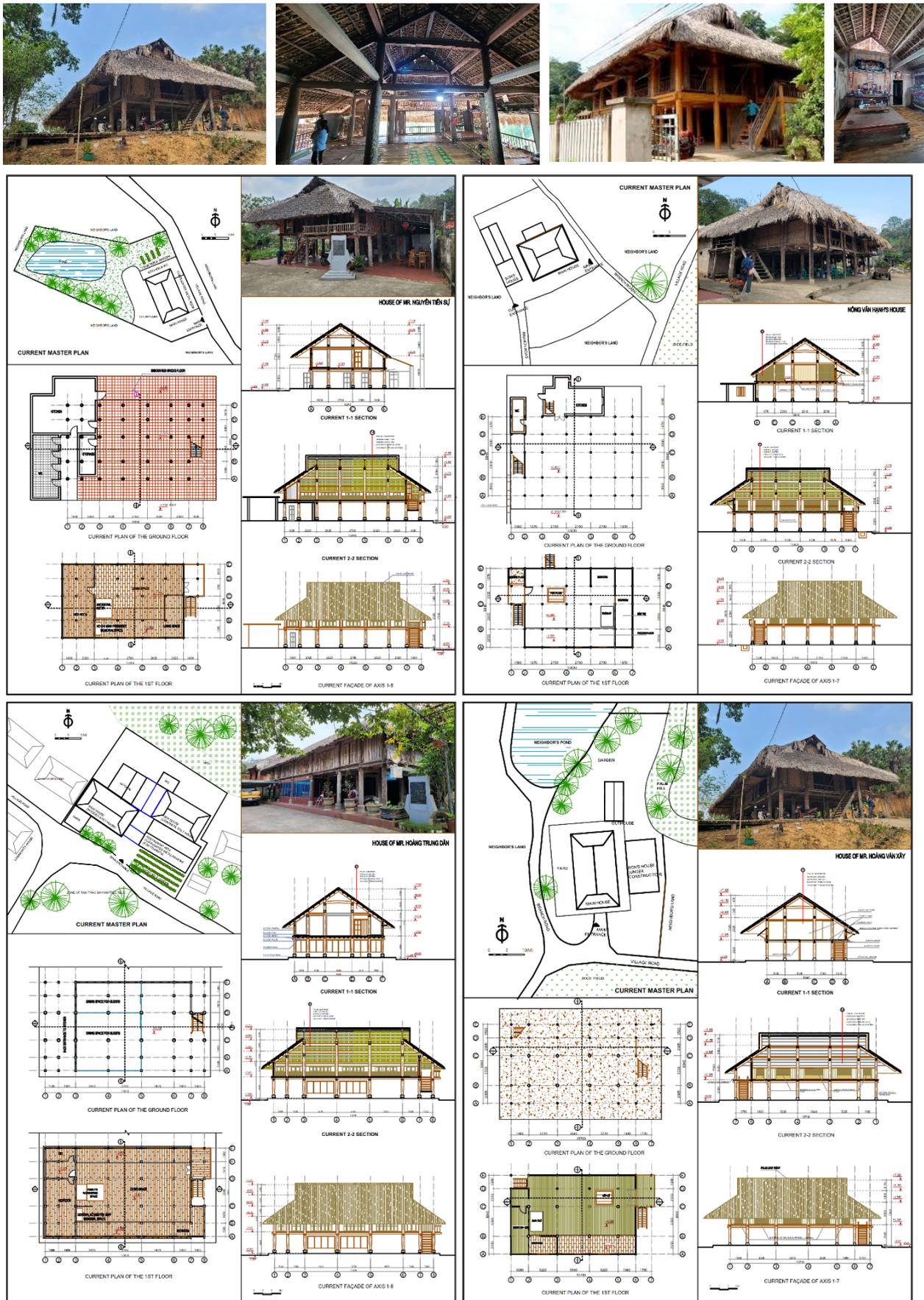


Fig. 4 Traditional architectural values of the Tay ethnic group, Tuyen Quang

## 6. Results and Discussion

### 6.1. Results

#### 6.1.1. Expert opinion

The research team employed the expert consultation method, gathering evaluations from 10 experts using a questionnaire format to assess and rank the essential criteria for sustainable development of Tay ethnic villages in Tuyen Quang province. The results obtained from the experts are as follows:



**Fig. 5** (a) Social justice criteria; (b) Criteria for sustainable economic growth; (c) Criteria for protecting and preserving the environment for the future; (d) Important criteria for prioritizing research areas

*Criterion 1:* Among the factors of social equity, enhancing community participation, rural modernization, and environmental quality improvement, the criterion of improving quality of life is considered the most important direction.

*Criterion 2:* Regarding sustainable economic growth, attention should be given to supplementing spaces that support economic development in the village, such as community-based tourism areas, shared landscape spaces, and festival/event spaces for small residential clusters.

*Criterion 3:* For the protection and preservation of the environment for the future, it is important to respect the natural terrain, consider house orientation, adapt to climate change, apply energy-saving technologies, protect water and air environments, and utilize local materials.

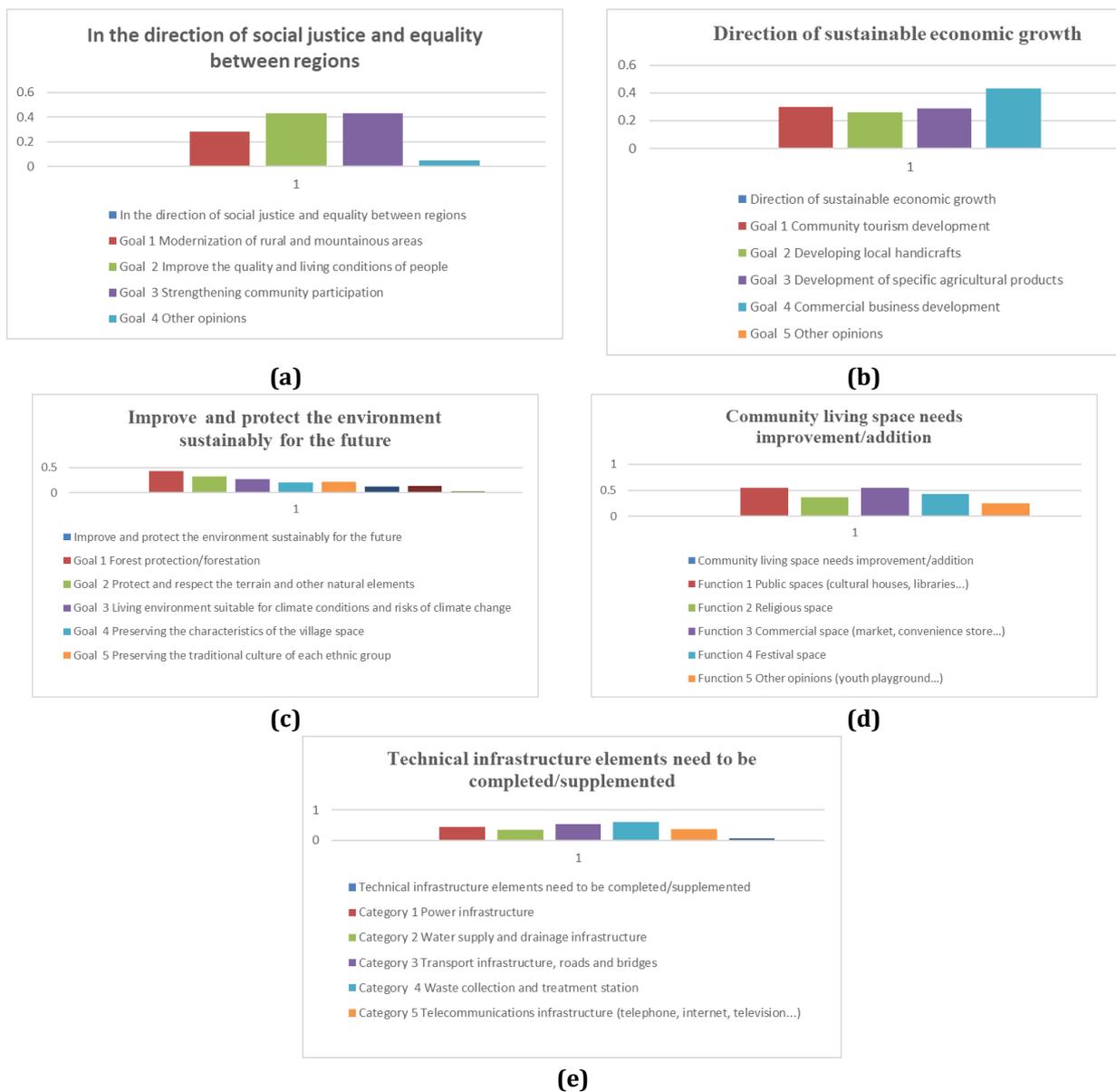
The results from the expert group indicate that economic growth for the community should be especially prioritized at the current stage in the research area.

#### 6.1.2. Community Survey Findings

This section presents the findings from a Sociological Survey on the Needs of the Tay Ethnic Community Orienting the Sustainable Development of Village Spaces Through the Preservation and Utilization of Traditional Architectural Values.

For the local community, the research team surveyed 100 ethnic minority residents in Tan Trao, Tuyen Quang, on the sustainable development of Tay ethnic village spaces, focusing on leveraging traditional architectural values. The results show different factors as below:

- **Social equity and enhanced community participation:** The community wants to live in a more modern area, with better living conditions and quality.
- **Sustainable economic growth:** In addition to maintaining traditional services, commercial services should be strengthened to increase community livelihoods.
- **Environmental protection and sustainability for the future:** The most important priority is forest ecosystem protection, followed by terrain and other natural ecosystems.
- **Community activity spaces need improvement:** There should be more focus on commercial spaces, followed by cultural spaces such as libraries and community centres.
- **Technical infrastructure needs to be improved:** The main areas that the community wants to see enhanced are the transportation system (bridges and roads) and the waste collection system.



**Fig. 6** (a) Social justice criteria; (b) Direction of sustainable economic growth; (c) Improve and protect the environment for the future (d) Public spaces need to be supplemented; (e) Technical infrastructure factors need to be enhanced

## 6.2. Assessment of Existing Village Conditions

Geography and climate conditions shape the distinctive landscape environment of the Tay ethnic communities in Tuyen Quang. In recent years, with the rapid development of integration and urbanization, the village landscapes and traditional architectural values have been gradually shifting toward modern urban landscapes. During this transition, natural and semi-natural elements that reflect local culture have been continuously replaced by man-made features, leading to a decline and eventual disappearance of natural elements.

Survey results from several Tay ethnic villages in Tuyen Quang indicate:

- Irrational land use structure: Due to geographic limitations, large flatlands are relatively scarce; houses are distributed along hillsides and built in accordance with the terrain. However, with the rapid development of the rural economy and improved economic conditions, communities not only renovate or rebuild their homes to meet daily and production needs, but also modify their surrounding environment. Unfortunately, due to the lack of comprehensive planning, land use becomes irrational, with scattered and chaotic housing layouts and disorganized functional zoning.
- Decline in the quality of the natural landscape: With increasing population growth and the desire to improve living standards through exposure to modern industry and technology, ethnic minority communities increasingly aspire to an urban-like living environment and have altered the landscape of their homes and yards accordingly. During this transformation, the key landscape feature that should be preserved in mountainous villages is the natural landscape. However, due to limited knowledge, awareness, and management, the quality of the natural environment is continuously declining. Residents may even level mountains or clear hills to build or shape the landscape around their homes.
- Lack of connection and transition between landscape environments: Currently, ethnic communities in villages are spontaneously transforming the external landscape environment of their homes. This process is primarily self-initiated, and due to the absence of a comprehensive master plan, the traditional mountain village landscapes are being replaced by new rural landscapes. As a result, many conflicts arise between the new and traditional landscapes, lacking proper transition and integration.
- Disappearance of local features and worsening pollution: In recent years, an increasing number of natural and semi-natural landscape elements such as hills, mountains, ponds, ancient trees, and fruit orchards-which form the identity and culture of the local community-have been replaced by artificial features such as concrete roads, water features, and public squares. The introduction of new technologies and materials has had a serious impact on the traditional landscape environment and its diversity: the use of hardened surfaces in yards and gardens, along with a decline in green space around buildings. These changes have exacerbated landscape pollution in the villages, leading to a lack of sustainability.

## 6.3. Case Study of Tan Lap, Tan Trao Commune

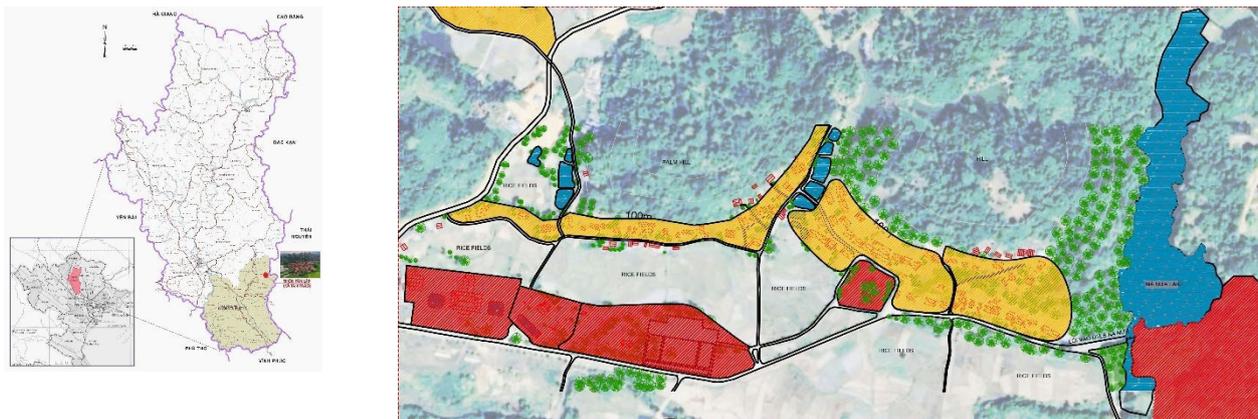
### 6.3.1. Current Practice of the Study Area

Tan Lap Village, located in Tan Trao Commune, Son Duong District, Tuyen Quang Province, is an important historical site in Vietnam. It was once known as the “Temporary Capital Center, the heart of the Vietnamese Revolution” during the August Revolution in 1945. The village consists of approximately 181 households, with over 97% of the population being of the Tay ethnic group. Many ancient stilt houses are still preserved here, reflecting the distinctive traditional culture of the local community. Notably, Tan Lap is home to two historically significant stilt houses: the house of Mr. Nguyen Tien Su, where President Ho Chi Minh lived and worked after returning from Pac Bo (Cao Bang), and the house of Mr. Hoang Trung Dan, where General Vo Nguyen Giap lived and worked from May to August 1945.

Today, Tan Lap is not only a historical site but also an attractive community-based tourism destination. With over 20 households involved in community-based tourism, visitors can experience local life and enjoy traditional dishes such as bamboo-cooked rice (com lam) and Tan Trao sticky rice wine. Through field surveys, the research team observed that thanks to various advantages, Tan Lap’s spatial structure possesses several unique characteristics:

- The village has a linear spatial layout, typical of traditional Tay villages, winding around the base of two natural hills to the north, with rice fields to the south, and Na Nua Lake to the east. Natural elements like hills, mountains, and the lake remain largely untouched by human development.
- Tan Lap is also part of the Tan Trao special national relic complex, alongside important sites such as the Temple of National Heroes, Tan Trao Communal House, Tan Trao Museum, Tan Trao Banyan Tree, and Na Nua Shack. This helps Tan Lap maintain a stable flow of tourists.
- The village continues to preserve traditional stilt house architecture, with some houses retaining high historical, cultural, and architectural value.

- With proper orientations for community-based tourism development, the village landscape remains harmonious, particularly due to the community's collective effort to maintain the traditional use of palm-leaf roofing materials (despite the fact that most houses have now shifted to reinforced concrete structures instead of traditional wooden frames).
- In addition, the research team identified several current issues in the village that need to be addressed:
- Public spaces are not yet appropriate for the village's development scale.
- Courtyards, gardens, and public landscapes have been heavily paved with concrete, reducing green space in the compounds and leading to a lack of harmony with the natural landscape.
- There is no centralized water supply system; households still rely on manually drawn water from the streams, resulting in inconsistency and lack of synchronization.
- While areas designated for homestays are subject to strict and specific regulations to ensure sustainable development, other areas are still developing in a disorderly and unplanned.
- Waste collection systems have not received adequate attention.
- The government's policy to eliminate temporary and dilapidated houses has not fully considered local cultural and ethnic factors. The focus should shift towards renovating and reorganizing living spaces, rather than simply altering the form and materials of buildings, as is currently the case.
- The use of new materials, particularly corrugated metal or plastic roofing has significantly impacted on the traditional landscape of the village.
- Increasing population density has led to a shortage of housing. Many new houses have been built in close proximity to old traditional houses as families divide households to provide homes for their children. This is especially noticeable near Na Nua, where new houses in the style of townhouses or tube houses are emerging due to urbanization trends.
- Limited land availability is also pushing development onto hillsides, which negatively affects the natural environment of the area. Another emerging trend is expansion into farmland, which poses a major threat to the landscape and spatial structure of the village.
- The number of original traditional houses remaining is very limited. The research team surveyed four remaining traditional houses, but they are significantly deteriorated.

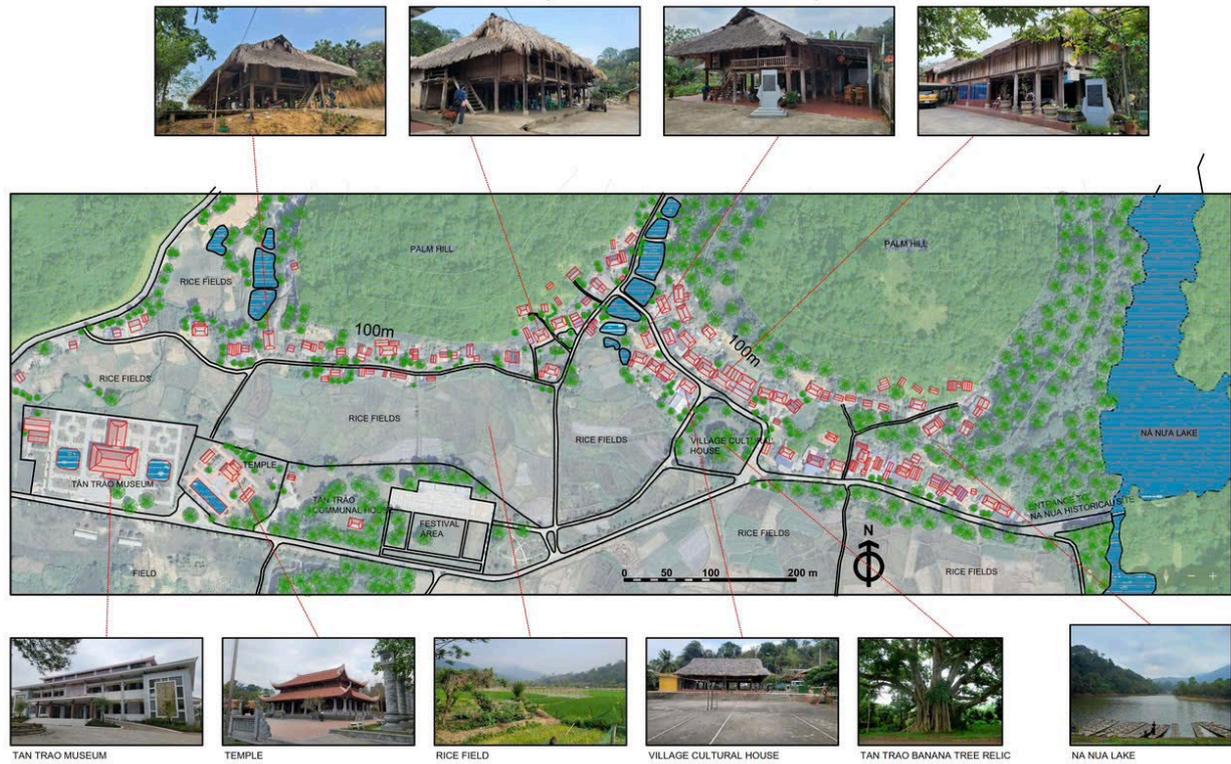


(a)

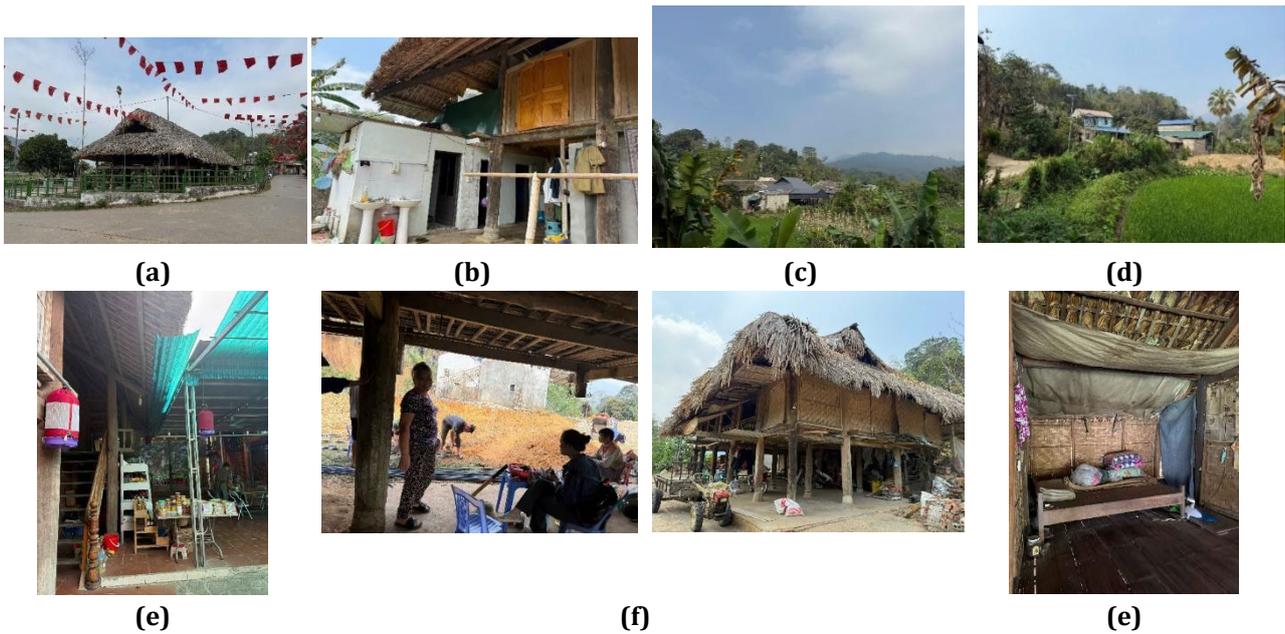


(b)

**Fig. 7** (a) Location map of Tan Lap village in Tuyen Quang province; (b) Photo of the village center with most of the houses serving community-based tourism (homestay)



**Fig. 8** Spatial structure of Tan Lap village, Tan Trao, Son Duong, Tuyen Quang



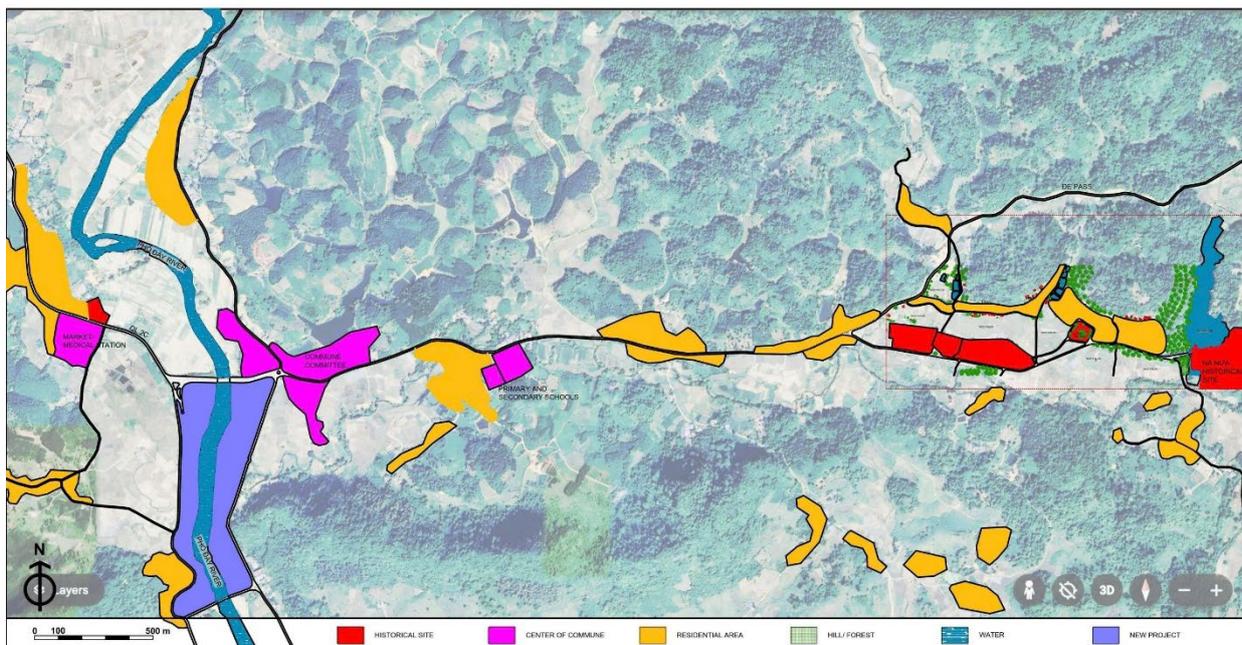
**Fig. 9** (a) The community center space is too small, not suitable for the present; (b) Traditional houses are deteriorating and need help to preserve them; (c)(d) Some areas develop haphazardly and spontaneously; (e) Living conditions need to be improved; (f) Many new houses are built into old traditional houses because the owners separate the households for their children to live separately

### 6.3.2. Spatial Needs for Sustainable Development

With the strategy of expansive development and the rapid growth of new urbanization, the landscape environment of Tay ethnic villages in the mountainous areas of Tuyen Quang province has changed significantly. The natural elements of the villages have continuously shifted in response to social development. The more advanced human civilization becomes, the weaker the influence of natural factors and the stronger the influence of social factors. Conversely, the more underdeveloped civilization is, the stronger the influence of nature and the weaker the role of social factors.

Through surveys of current village spatial conditions and assessments of community needs among the Tay ethnic people in Tan Trao, Tuyen Quang, the research team identified the following key findings:

- **Cultural spaces and libraries:** To support the sustainable development of village space, residents wish to add more cultural development areas such as libraries and community centers. These are seen as essential for connecting people and fostering community knowledge.
- **Market and commercial spaces:** This was the most widely requested feature among residents. With proper market and commercial spaces, locals hope to access new social trends and boost their livelihoods through trade and commerce.
- **Waste collection and treatment areas:** Currently, this function is not clearly planned within the village, resulting in environmental pollution and creating a negative image of the local landscape.
- **Protection of forests and natural elements:** Based on traditional rice cultivation and livelihood models, the Tay people have continuously adapted their construction practices to the mountainous terrain and various hydrological conditions, shaping village layouts that harmonize with the local natural environment. For hundreds of years, their construction practices emphasized forest protection, responsible water use, and disaster prevention through a variety of methods. They also established rules to strengthen environmental management - all contributing to the long-term sustainability of the village. These needs and values remain strong and relevant today.
- **Promoting community participation:** The community desires to be actively involved in the sustainable development of the village. Maximizing the use of traditional architectural values will help residents preserve the cultural heritage passed down by their ancestors, as they are the primary stakeholders in these preservation activities.



**Fig. 10** Spatial structure zoning map of Tan Trao commune

Thus, based on the survey of community needs and the current status of public spaces in the village. List of items that need to be added as Table 1.

**Table 1** *List of items that needed*

No	Identifying items that need to be added to the Tay ethnic village, Tan Trao, Tuyen Quang
1	Improve the quality and living conditions of people
1.1	Commercial business space
1.2	Community-based tourism space
1.3	Cultural space, library
1.4	Space for developing specific agricultural products
1.5	Space to develop local handicraft products
1.6	Waste collection and treatment area
2	Promoting community participation
3	Protect and respect terrain and other natural elements (rivers, grasslands, etc.)
4	Habitat for Climate Change Risk

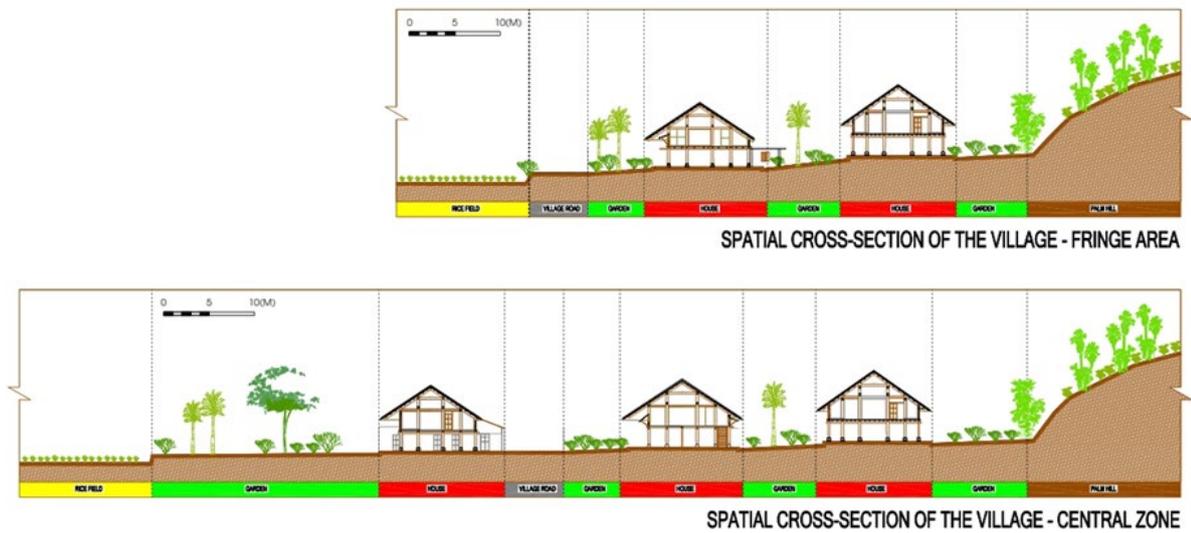
## 6.4. Planning and Design Proposals

### Orientation for adjusting the existing functional space of the village

#### Organising landscape space

To sustainably develop the spatial environment of Tay ethnic villages in Tan Trao, Tuyen Quang province by leveraging the value of traditional architecture, the research team proposes the following orientations:

- Respect for traditional architectural values and emphasis on local identity: The design of mountainous village spaces should highlight local characteristics and avoid visual and structural uniformity between urban and mountainous areas. Therefore, preserving and conveying the values of traditional architecture must be considered a key strategy in maintaining the distinctive identity of these ethnic mountain villages.
- Traditional housing and landscape environment: Homes do not exist in isolation—they are part of the built environment and have a direct impact on village space. Due to the mountainous terrain, houses are scattered along hillsides, creating a unique landscape that forms an essential component of the village space. Hence, the research team recommends a careful and sensitive approach to the relationship between traditional housing and village space to ensure that homes harmonize with their surrounding environment, and vice versa. The transition from traditional wooden structures to reinforced concrete houses has become widespread due to the increasingly limited supply of timber. In light of this trend, the team proposes preserving traditional roof forms—especially the continued use of palm leaf roofing, a local, sustainable, environmentally friendly material that fits well with the landscape.
- Other landscape elements: Mountain villages of ethnic minorities still possess large and unique land reserves, including fields, forests, rivers, and streams. These are the most defining features of mountainous village spaces, strongly reflecting local identity and forming the basis of traditional spatial forms. Thus, sustainable village development must take advantage of the area's topography—a defining characteristic of the region—to ensure that man-made landscapes integrate with the natural environment, preserving the original ecological landscape. For example, elements such as fences, fruit gardens, and farmland—from the materials used in yards and gardens to types of vegetation—should be prioritized in planning and design.



(a)



(b)



(c)

**Fig. 11** (a) Preserving the traditional structure of the village; (b) Preserve and protect the remaining traditional houses; (c) Some architectural values need to be exploited.

### Organization of Agricultural Production Spaces

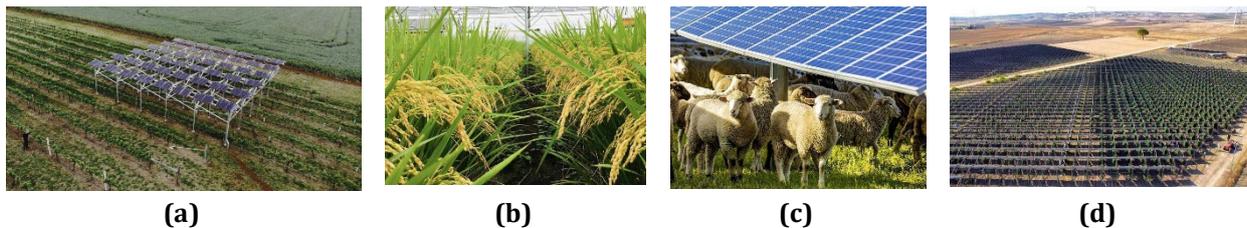
As a purely agricultural village, the livelihood of the local community primarily depends on wet rice farming. Therefore, organising agricultural production spaces is essential for a sustainable development strategy. This is a traditional space that should be leveraged during development. Sustainable development in the long term must be rooted in a reflection on traditional living environments. In reality, we must take into account the living and production needs of villagers to guide reasonable changes to the village environment.

In Tan Lap village, the research team proposes implementing high-tech agriculture and utilizing renewable energy sources.

### Organization of Technical Infrastructure Systems (transportation, electricity, water supply)

Depending on the conditions of each village, natural resources must always be protected and used in a limited and reasonable manner. In the sustainable development of village spaces, a deeper understanding of the concept of recycling is needed. Resources should be reused across various contexts and conditions appropriate to the current development stage.

- Water resource management in the study area is a pressing issue, as water is currently sourced from mountain streams for irrigation, food production, and household use. Thus, water resource management must be adjusted to meet the community's basic needs.
- Solar energy use: Consider installing solar panels in accordance with the orientation of traditional houses.
- Solar-powered street lighting.
- Photovoltaic sculptures and decorative installations.
- Application of biogas technology: This will help realize the circular organic regeneration of the environment and promote sustainable village development. The community should be involved in "clean projects," fostering the use of biogas to support daily life.



**Fig. 12** High-tech agriculture (a) Solar panels installed at a vineyard in Australia. Photo courtesy of Greenwood Energy; (b) Research on solar power installation in Japanese rice fields. Photo courtesy of Mainichi; (c) Sheep farming project at the solar farm. Photo courtesy of Lightsource bq; (d) La Svolta vineyard. Photocourtesy of Vinetur

### Environmental Sanitation Management (Waste and Wastewater Collection)

The issue of waste and waste collection affects all areas where production activities take place (including tourism), but managing waste is even more challenging in locations where the natural environment plays a critical role—especially in mountainous regions. Recycling and treatment methods (such as incineration or landfilling) can still have harmful impacts on the environment, which future generations will have to bear [31].

Minimizing and managing waste in these areas requires more effort and is more costly than in other regions due to the influence of geographic, socio-economic, and climatic conditions.

Key waste management strategies include:

- Waste management solutions must not harm people or the environment;
- Waste should be treated as close to its source as possible to avoid spreading pollution;
- Clear identification of waste sources is essential for appropriate treatment;
- Promote organic composting methods;
- Pollution costs should not only be borne by the community as a whole but also by individuals;
- Encourage selective waste sorting and collection, and develop an efficient collection system.

## 6.5. Discussion

The research results reveal that the spatial structure and sustainability of Tay ethnic villages in Tuyen Quang province—shaped over centuries of migration, development, differentiation, and construction—are still clearly preserved in Tan Lap village, Tan Trao commune, Tuyen Quang. Over the years, however, the construction and development processes of these villages have paid insufficient attention to forest protection and the sustainable use of water resources, thereby failing to ensure settlement sustainability long-term. Furthermore, the resettlement areas of these villages currently lack strategic direction and clear planning, resulting in spontaneous and unregulated development.

In order to realize the research group's findings and recommendations, attention must be focused on the following core issues:

- Strategic planning is essential. In village planning and design, the natural conditions must be fully respected—particularly the topography (contour lines, natural landscapes, etc.).
- Traditional housing architecture, with its high indigenous value, should be integrated with modern construction technologies and materials to fully harness the value of this traditional heritage.
- A distinct architectural identity must be maintained to serve as a recognizable characteristic of Tay ethnic villages in Tuyen Quang and to differentiate them from other ethnic settlements.

- Preservation of existing valuable structures should be prioritized to the greatest extent possible.
- Establish a cultural library model to archive traditional knowledge and local experiences in village construction and development.
- Ensure social equity and enhance community participation in activities ranging from the preservation of architectural heritage to environmental protection for future generations (e.g., waste control, sustainable energy use, etc.).
- Foster sustainable economic growth for local communities through the promotion of community-based tourism spaces, technical infrastructure, and the application of scientific and technological advances.
- Protect and conserve the environment for future generations by organizing and developing traditional architectural values in ways that suit local climate conditions, respect the natural terrain, and utilize local materials.

## 7. Conclusion, Recommendations and Future Research

### 7.1. Conclusion

The sustainable development of Tay ethnic village spaces in Tuyen Quang Province—through the preservation and integration of traditional architectural values—requires a holistic, culturally sensitive, and environmentally informed approach. The Tay people's long-standing relationship with their natural surroundings has given rise to distinctive spatial structures and architectural forms that not only reflect environmental adaptation but also carry deep cultural significance.

This study assessed the current condition of traditional Tay village spaces, with a focus on Tan Lap Village in Tan Trao Commune, and identified strategies for leveraging architectural heritage to promote sustainable rural development. Through literature review, field surveys, expert consultations, and community interviews, the research found that balancing modernization with the preservation of cultural identity is both a pressing challenge and a viable pathway for inclusive, sustainable progress.

However, this study has several limitations. First, the research focused primarily on a single case study—Tan Lap Village—which may limit the generalizability of the findings to other Tay villages or ethnic communities with different socio-cultural and geographic contexts. Second, while the methodology incorporated expert and community perspectives, it lacked longitudinal data and in-depth ethnographic observation over time, which would provide a more dynamic understanding of social and spatial changes. Third, the research primarily relied on qualitative methods; future studies may benefit from integrating quantitative assessments, such as GIS-based spatial analysis or environmental performance metrics, to enhance the precision of planning proposals.

Despite these limitations, this study offers a valuable foundation for policymakers, planners, and scholars interested in heritage-based development and community-driven rural revitalization.

### 7.2. Recommendations

Based on the findings, the following recommendations are proposed:

1. **Integrate Traditional Values into Spatial Planning**  
Ensure that village development plans incorporate traditional architectural elements and respond to local topography, culture, and environmental conditions.
2. **Strengthen Community Participation and Cultural Revitalization**  
Actively involve local residents in planning processes and establish public spaces—such as cultural centers and libraries—that promote community interaction and knowledge preservation.
3. **Develop Community-Based Tourism Strategically**  
Encourage tourism models that are culturally respectful, environmentally sound, and economically beneficial, while protecting the integrity of traditional village spaces.
4. **Improve Technical Infrastructure with Environmental Sensitivity**  
Invest in essential infrastructure—such as water supply, waste management, and renewable energy—designed to fit mountainous terrain and minimize environmental impact.
5. **Preserve and Restore Traditional Houses**  
Provide technical and financial support for the restoration of historically and architecturally significant houses, prioritizing the use of local materials and techniques.
6. **Implement Comprehensive Land Use and Zoning Plans**  
Avoid fragmented development by adopting master planning frameworks that consider cultural, environmental, and functional factors in a cohesive manner.
7. **Promote Sustainable Agricultural Practices**

Support traditional and innovative farming models that reinforce local livelihoods and complement the landscape and spatial identity of the village.

These recommendations provide a practical and culturally embedded roadmap for sustainable development in Tay ethnic villages and similar rural contexts.

## 7.2. Further research

To deepen understanding and extend the applicability of this work, future studies should explore:

- **Architecture of Public Spaces:** Examine the spatial organization and community functions of public buildings in Tay villages to inform culturally resonant design strategies.
- **Roofing Systems and Materials:** Analyze traditional roofing forms, materials, and symbolism in Tay architecture to develop environmentally responsive and culturally appropriate construction guidelines.
- **Architectural Gene Mapping:** Identify and document distinctive architectural elements to define the “architectural gene” of the Tay ethnic group, supporting heritage preservation and innovation.
- **Housing Adaptation Models:** Develop adaptable housing prototypes that integrate traditional values with contemporary living needs, aligning with Vietnam’s rural modernization agenda.

Expanding the scope of future research will enable more comprehensive and scalable approaches to preserving ethnic minority heritage while promoting sustainable development.

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## Conflict of Interest

Authors declare that there is no conflict of interests regarding the publication of the paper.

## Author Contribution

The authors confirm contribution to the paper as follows: **study conception and design:** Author Nguyen Dinh Thi, Vu Thi Huong Lan; **data collection:** Author Pham Thi Hong Tho, Le Nam Phong; **analysis and interpretation of results:** Nguyen Dinh Thi, Nguyen Hoai Thu; **draft manuscript preparation:** Vu Thi Huong Lan, Pham Thi Hong Tho, Le Nam Phong. All authors reviewed the results and approved the final version of the manuscript.

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