



Patterns of Spatial Transformation in Traditional Houses of Bayung Gede Village, Bali

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Abstract—This study aims to identify the patterns and levels of spatial transformation in traditional houses in Bayung Gede Village and to examine the adaptation processes within the socio-cultural and spatial cosmological context of the *Bali Aga* community. A qualitative descriptive approach was employed using a case study method, involving field observations, semi-structured interviews, and plan reconstruction of six purposively selected house samples. The findings reveal that spatial transformations can be categorized into four main patterns: addition of utility spaces, expansion of domestic spaces, functional transformation, and adaptation of activity spaces. Furthermore, the transformations are classified into three levels minor, moderate, and major based on the degree of intervention in spatial structure and the *Hulu-Teben* zoning system. The analysis indicates that transformations predominantly occur in the *teben* zone, which is profane and more flexible, while the *hulu* zone remains preserved. This study contributes by integrating the analysis of transformation patterns and levels within the *Hulu-Teben* cosmological framework, demonstrating that spatial transformations in traditional houses occur in an adaptive and selective manner while maintaining the identity of vernacular architecture.

Keywords: spatial transformation; vernacular architecture; *hulu-teben*; *Bali Aga*.

1. Introduction

Traditional architecture constitutes an integral part of cultural heritage, reflecting the interrelationship between humans, the environment, and the social values that evolve within a community. In vernacular architecture studies, a house is not merely understood as a physical shelter, but also as a manifestation of cultural values and ways of life that develop over generations (Rapoport, 1969; Oliver, 2006; Lawrence, 2012). The form and spatial organization of houses are generally shaped by the interaction of social, cultural, climatic, and environmental factors.

Changes in traditional architecture are inevitable as societies evolve over time. Processes such as modernization, shifts in lifestyle, and socio-economic dynamics influence both the form and spatial configuration of traditional houses. These changes may occur through the addition of spaces, functional transformation, and modifications of building elements to

accommodate contemporary living needs (Habraken, 1998; Tipple, 2000). Within the context of vernacular architecture, such transformations are understood as gradual spatial adaptations that occur without eliminating the fundamental structure and embedded cultural values (Rapoport, 2005; Rahmi & Setiawan, 2017).

Balinese traditional architecture is generally structured based on cosmological principles that regulate the relationship between humans, nature, and religious beliefs. Spatial organization is commonly guided by the concepts of *Tri Hita Karana* and *Tri Mandala*, which divide space into sacred, intermediate, and profane zones (Parimin, 1986; Adiputra et al., 2016). However, the application of these principles is not uniform across all regions of Bali, particularly in Bali Aga settlements, which exhibit distinct cultural and spatial characteristics.

In Bali Aga settlements, spatial systems vary according to geographical conditions, local traditions, and historical development. Bayung

Gede Village, as one of the Bali Aga settlements, demonstrates a spatial arrangement that does not fully conform to lowland Balinese architectural principles. Instead, the spatial organization of traditional houses in this village is primarily influenced by the *Hulu-Teben* concept, which distinguishes sacred (*hulu*) and profane (*teben*) spaces based on orientation toward the mountain (*kaja*) and the sea (*kelod*) (Adiputra et al., 2016). This indicates a localized adaptation of Balinese cosmological principles that is contextually grounded.

Previous studies have largely focused on settlement patterns and morphological changes in Bali Aga villages, particularly in relation to tourism development (Pangasih & Asvitasari, 2016). However, studies that specifically examine spatial transformation at the level of individual houses remain limited, especially those that link spatial change patterns with local cosmological systems.

Based on this context, this study aims to identify the patterns and levels of spatial transformation in traditional houses in Bayung Gede Village and to analyze how these transformations occur within the framework of the *Hulu-Teben* concept. This study contributes by integrating the analysis of transformation patterns and classification of transformation levels, thereby providing a more comprehensive understanding of spatial adaptation processes in vernacular architecture at the dwelling scale.

2. Methods

This study employs a qualitative descriptive approach using a case study method to examine the phenomenon of spatial transformation in traditional houses in Bayung Gede Village. This approach is chosen as the research focuses on understanding the existing spatial conditions and the dynamics of change within the socio-cultural context of the community.

The study was conducted in Bayung Gede Traditional Village, Kintamani District, Bangli Regency, Bali. This location was selected because it represents one of the Bali Aga settlements that still preserves traditional settlement characteristics and a spatial system based on Balinese cosmological principles (Idedhyana, 2011). The object of the study focuses on traditional houses within a single compound unit known as *karang umah*.

Samples were selected using purposive sampling, considering variations in house types and forms of spatial transformation. Six houses were chosen as samples, consisting of both ordinary houses and *jero* houses, to represent the diversity of traditional housing conditions and transformation patterns in Bayung Gede Village. Data were collected through field observations, semi-structured interviews, and visual documentation.

Observations were conducted to identify existing spatial configurations, physical changes in buildings, and spatial relationships within the compound. Interviews with residents were carried out to gather information on the history of spatial changes, space functions, and factors influencing these transformations. Visual documentation, including photographs and sketches, supported the process of plan reconstruction.

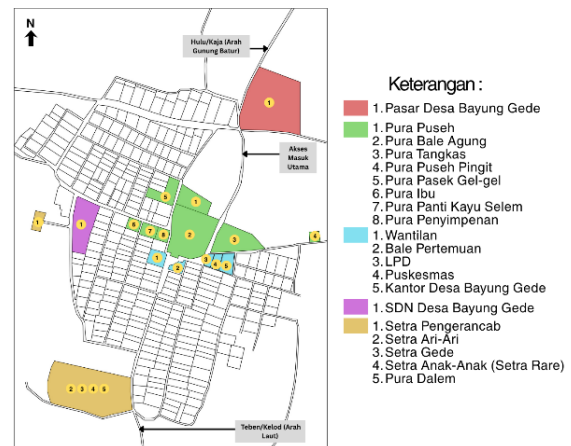


Figure 1. Map of Bayung Gede Village
Source: Rukmana, et.al, 2026

Data analysis was conducted through several stages. First, house plans were reconstructed based on field observations and interview data. Second, spatial transformations were identified by comparing existing conditions with the traditional spatial layout. Third, the identified transformations were analyzed using a classification framework of spatial transformation patterns, including the addition of utility spaces, expansion of domestic spaces, functional transformation, and adaptation of activity spaces. This framework was developed based on theories of vernacular architecture and spatial adaptation (Rapoport, 2005; Habraken, 1998; Rahmi & Setiawan, 2017).

Furthermore, the level of spatial transformation was classified into three categories: minor, moderate, and major. This classification is based on three main criteria: (1) the extent and number of spaces affected, (2) the location of changes within the *Hulu-Teben* zoning system, and (3) the impact of changes on the traditional spatial structure. The categorization process refers to the concept of incremental change in vernacular architecture (Rapoport, 2005; Habraken, 1998), as well as principles of spatial adaptation in traditional buildings.

3. Results and Discussion

Before analyzing spatial transformations in traditional houses, the initial stage of this study focused on identifying the spatial distribution of sample houses in Bayung Gede Village. This step aims to establish the spatial context of the selected houses and to examine their relationship with the overall pattern of the traditional settlement. In vernacular architecture studies, understanding the spatial context of a settlement is essential, as the organization of individual houses cannot be separated from the broader settlement structure (Rapoport, 1969). The six selected house samples are considered representative of the overall condition of traditional houses in Bayung Gede Village. The selection was based on variations in house types namely ordinary houses and *jero* houses as well as their distribution within the settlement structure. Therefore, the selected samples not only reflect variations in spatial transformation but also represent the general characteristics of traditional houses in the village. The six selected house samples are considered representative of the overall condition of traditional houses in Bayung Gede Village. The selection was based on variations in house types namely ordinary houses and *jero* houses as well as their distribution within the settlement structure. Therefore, the selected samples not only reflect variations in spatial transformation but also represent the general characteristics of traditional houses in the village.

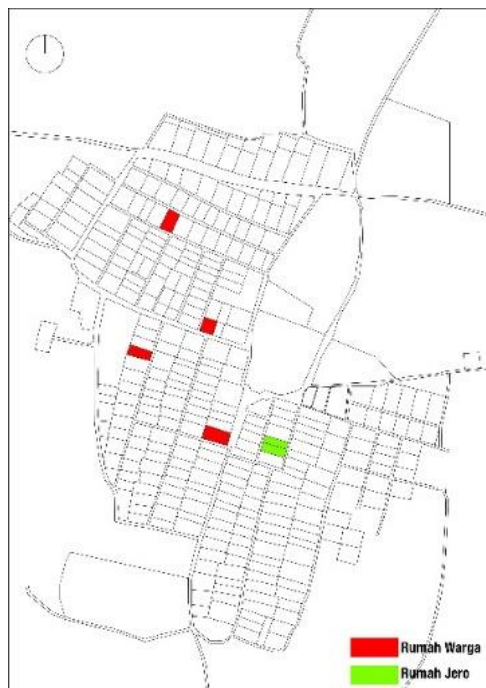


Figure 2. Distribution map of sample houses
Source: Rukmana, et.al, 2026

Traditional Bali Aga settlements typically exhibit a linear spatial structure aligned with the cosmological orientation from the mountain to the sea. This orientation reflects a cosmological framework that distinguishes between sacred and profane domains (Parimin, 1986). In Bayung Gede Village, this settlement pattern remains evident through the arrangement of houses that follow the village spatial orientation, as well as the interconnected relationships between house compounds within the settlement.

Based on field mapping, the sample houses are distributed across several parts of the village that still retain traditional housing characteristics. This mapping was conducted to illustrate the relative positions of each house and to ensure that the selected samples adequately represent the diversity of traditional house conditions in Bayung Gede Village. This approach aligns with architectural research methods that emphasize the importance of spatial analysis in understanding the relationship between buildings, their environment, and settlement patterns (Groat & Wang, 2013).

Spatial Characteristics of Traditional Houses in Bayung Gede Village

Traditional houses in Bayung Gede Village are generally organized within a compound unit known as *karang umah*. Within this compound, several key spatial elements are arranged to accommodate domestic, social, and religious functions. These elements include the *bale pegaman*, *paon* (kitchen), *jineng* (rice barn), and *sanggah*, which serves as the family shrine (Idedhyana, 2011).

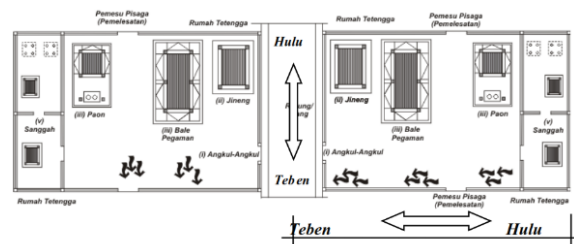


Figure 3. Original layout of the traditional houses Bayung Gede

Source: Adiputra & Adhimastra, 2019

The spatial organization of traditional Balinese houses is not solely determined by functional considerations but is also strongly influenced by the cosmological system embraced by the community. The Hulu-Teben concept serves as a fundamental principle in defining spatial orientation. In this framework, the direction toward the mountain (*kaja*) is considered sacred, while the direction toward the sea (*kelod*) is regarded as profane (Adiputra et al., 2016). This orientation significantly influences the arrangement of spatial elements within the house.

Parimin (1986) explains that spatial organization in traditional Balinese settlements reflects the relationship between the macrocosm and microcosm, expressed through spatial orientation and the configuration of building elements. Field observations indicate that most of the sampled houses still retain this fundamental spatial structure.

Key elements such as the *jineng*, *bale pegaman*, *paon*, and *sanggah* are still present in nearly all sampled houses, indicating that the traditional spatial system continues to play an important role in the daily life of the Bayung Gede community. However, socio-economic dynamics and evolving housing needs have led to various modifications in the spatial organization of these traditional houses.

Variations in Spatial Transformation

Based on observations of six sample houses, various forms of spatial transformation were identified in traditional houses in Bayung Gede Village. These transformations generally include the addition of new spaces, changes in spatial functions, and spatial adjustments to support occupants' daily activities.

Table 1. Spatial Transformation Analysis of Sample Houses

No	House Code	House Type	Spatial Changes	Transformation Pattern
1	RW1	Ordinary Houses	Bathroom, well	Utility Addition
2	RW3	Ordinary Houses	Shop (warung)	Functional Transformation
3	RW4	Ordinary Houses	New Kitchen	Domestic Expansion
4	RW8	Ordinary Houses	Multi-purpose space	Activity Adaptation
5	RJ4	Jero House	Modern Kitchen	Domestic Expansion
6	RJ5	Jero House	Storage space	Utility Addition

Sources: Rukmana, et al., 2026.

The most dominant form of transformation is the addition of utility spaces, such as bathrooms, wells, and storage areas. These additions reflect an increasing demand for improved residential facilities. From a vernacular architecture perspective, such changes can be understood as adaptive responses to

technological developments and rising living standards, where sanitation and comfort become increasingly important (Rapoport, 1969). Furthermore, Habraken (1998) argues that transformations in residential environments often occur through direct interventions by occupants in response to everyday needs, resulting in incremental spatial modifications.



Figure 4. Layout plan of sample houses
Source: Rukmana, et.al, 2026

Several houses also exhibit expansion of domestic spaces, particularly in kitchen areas. The addition of modern kitchens is generally driven by the use of more advanced cooking equipment and the growing spatial requirements of household activities. This indicates that domestic spaces are among the most flexible components of traditional houses and tend to evolve alongside changes in family lifestyles (Rapoport, 1969).

In vernacular architecture, domestic spaces frequently become the primary sites of transformation due to their direct association with daily activities. In some cases, functional transformation is also observed, where parts of the house are converted into economic spaces, such as the *warung* in house RW3. This reflects the integration of residential and economic functions within a single spatial unit. This phenomenon aligns with Oliver (2006), who emphasizes that in traditional societies, houses often serve not only as living spaces but also as productive environments that support household economic activities.

Overall, the variations in spatial transformation observed in houses RW1, RW3, RW4, RW8, RJ4, and RJ5 indicate that spatial changes in traditional houses in Bayung Gede Village are not random but represent adaptive responses to social, economic, and activity-related needs of the occupants. This finding reinforces the view that the form and organization of space in

traditional houses are strongly influenced by the dynamic nature of everyday life (Rapoport, 1969).

Spatial Transformation Patterns

Based on the analysis of the sampled houses, spatial transformations in traditional houses in Bayung Gede Village can be classified into four main patterns.

Table 2. Spatial Transformation Patterns

Transformation Pattern	Form of Change	House Code
Utility addition	Bathroom, well, storage	RW1, RJ5
Domestic Expansion	Modern Kitchen	RW4, RJ4
Functional Transformation	Shop (warung)	RW3
Activity Adaptation	Multi-purpose space	RW8

Sources: Rukmana, et al., 2026.

These transformation patterns indicate that traditional houses undergo gradual spatial adaptation without eliminating their fundamental structural organization. Rahmi and Setiawan (2017) explain that changes in vernacular architecture generally occur through incremental processes that preserve the essential character of traditional buildings.

The addition of utility spaces, such as bathrooms, wells, and storage areas is the most commonly observed transformation. These additions are typically located in peripheral areas or within the compound without altering the core structure of the house. Another pattern involves the expansion of domestic spaces, particularly in kitchen areas. The introduction of modern kitchens reflects the need to accommodate daily cooking activities while responding to increasing spatial demands within the household. From a vernacular architecture perspective, transformations in domestic space are often driven by evolving household practices and changing lifestyles (Rapoport, 1969).

The third pattern is functional transformation, where parts of the dwelling are converted into economic spaces, such as the *warung* observed in house RW3. This transformation demonstrates the dual role of traditional houses as both living spaces and sites of economic activity. Such integration is commonly found in rural settlements, where residential spaces support household-based economic functions (Oliver, 2006).

The fourth pattern is activity-based spatial adaptation, manifested in the creation of multi-

purpose spaces used for various family activities. This type of transformation reflects a high degree of spatial flexibility in traditional houses. Rather than undertaking major structural alterations, residents tend to make limited adjustments to existing spaces to accommodate changing activity needs.

An examination of spatial transformation across the sampled houses RW1, RW3, RW4, RW8, RJ4, and RJ5 reveals that each house undergoes different forms of modification depending on the needs and activities of its occupants. These changes include the addition of new spaces, functional shifts, and adjustments within domestic areas. Despite this variation, recurring patterns can be identified across the cases. From a vernacular architecture perspective, such transformations represent adaptive responses to evolving social and economic conditions (Rapoport, 1969). Based on shared characteristics observed across the samples, these variations can be synthesized into the four principal transformation patterns identified in this study.



Figure 5. Synthesis diagram of spatial transformation
Source: Rukmana, et.al, 2026

The diagram illustrates the synthesis of spatial transformation patterns derived from the analysis of the sampled houses in Bayung Gede Village. The identified transformations can be grouped into four main categories: utility addition, domestic expansion, functional transformation, and activity adaptation. Utility additions typically include bathrooms, wells, and storage spaces, reflecting increased demand for modern housing facilities. Domestic expansion is primarily expressed through the addition of modern kitchens to support household activities. Functional transformation is evident in the conversion of residential spaces into economic spaces, such as *warung*, while activity adaptation is reflected in the

emergence of multi-purpose spaces used for various family activities.

These patterns demonstrate that spatial transformation in traditional houses in Bayung Gede Village occurs through a gradual adaptation process that does not disrupt the fundamental spatial structure. Core elements such as the *jineng*, *bale pegaman*, *paon*, and *sanggah* within the *karang umah* compound remain preserved (Idedhyana, 2011). This finding aligns with vernacular architecture theory, which emphasizes that spatial organization is closely linked to the social and economic dynamics of its inhabitants (Rapoport, 1969). Furthermore, transformations in traditional architecture typically occur through incremental additions or modifications without eliminating the building's core identity (Rahmi & Setiawan, 2017).

Classification of Spatial Transformation Levels

Based on the analysis of the six sample houses, spatial transformations in traditional houses in Bayung Gede Village can be classified into three levels: minor, moderate, and major. This classification is determined by the degree of intervention in the spatial structure, the extent of the modified area, and its impact on the traditional spatial organization within the *karang umah* compound.

In vernacular architecture studies, changes in traditional dwellings generally occur gradually through adaptive processes influenced by occupants' needs, without fundamentally altering the core structure of the building (Rapoport, 1969; Rahmi & Setiawan, 2017). Habraken (1998) further explains that transformations in residential environments can be categorized based on levels of intervention, ranging from incremental modifications to more transformative changes affecting the overall spatial system.

Accordingly, the classification applied in this study considers three main criteria: (1) the number and extent of spaces affected, (2) the location of changes within the Hulu-Teben zoning system, and (3) the impact of these changes on the traditional spatial arrangement.

Table 3. Classification of Spatial Transformation Levels in Sample Houses

House Code	Type of Change	Location of Change	Level of Change
RW1	Bathroom, well	Teben zone (edge of compound)	Minor
RW4	Kitchen and Domestic space	Teben-central zone	Moderate
RW3	Shop (warung)	Almost entire teben	Moderate -Major

zone			
RW8	Multi-purpose space	Teben-central zone	Moderate -Major
RJ5	Storage Space	Teben zone	Minor
RJ4	Modern Kitchen	Teben-central zone	Moderate

Sources: Rukmana, et al., 2026.

Minor transformations represent low-level interventions that do not alter the fundamental spatial structure of traditional houses. These changes typically involve the addition of utility spaces, such as bathrooms, wells, or storage areas, usually located at the edges of the compound or within the *teben* zone. In this study, minor transformations are observed in houses RW1 and RJ5, where the additions are limited in scale and do not affect key spatial elements such as the *sanggah*, *bale pegaman*, and *paon*.

This condition reflects an incremental mode of change, consistent with vernacular architecture principles in which transformations occur gradually without disrupting the core spatial structure (Habraken, 1998; Rapoport, 1969). Moreover, the placement of these changes within the *teben* zone indicates that profane spaces are more flexible and accommodating to intervention compared to sacred zones (Parimin, 1986; Adiputra et al., 2016).

Moderate transformations involve the addition or modification of domestic spaces that have a more noticeable impact on spatial organization, while still maintaining the primary structure of the traditional layout. This type of change is identified in houses RW4 and RJ4, which exhibit expansion of kitchen and domestic areas, as well as in house RW8, where a relatively large multi-purpose space has been added. Based on the plan analysis (highlighted in red), these changes indicate increased spatial use intensity within the *teben* and partially central zones.

From a vernacular architecture perspective, domestic spaces are the most adaptable components and tend to evolve in response to changes in household activities (Rapoport, 1969). Rahmi and Setiawan (2017) also note that transformations in traditional buildings often occur through gradual spatial adaptations, particularly in spaces associated with daily activities. In the case of RW8, the relatively extensive modification suggests a tendency toward major transformation, yet it still retains the main elements of the traditional structure, thus categorized as moderate-major.

Major transformations represent high-level interventions that significantly affect both spatial function and organization. These changes involve not only the addition of space but also functional transformation that alters the overall pattern of space utilization within the house. This is evident in house

RW3, where a large portion of the house particularly within the *teben* zone has been converted into a commercial space (*warung*). Based on the plan, the transformed area covers most of the lower part of the compound, indicating a shift from purely residential use to economic function.

This phenomenon aligns with Oliver (2006), who emphasizes that in traditional societies, houses often serve dual roles as both living spaces and productive environments supporting household economic activities. Such transformation reflects a high level of adaptation to economic demands and represents a significant shift in spatial use.

Overall, the classification of transformation levels demonstrates that spatial changes in traditional houses in Bayung Gede Village occur progressively, with varying degrees of intervention ranging from minor to major. However, most transformations are concentrated in the *teben* zone, which is profane in nature, thereby preserving the sacred spatial structure defined by the Hulu–Teben concept. This indicates that spatial transformations continue to follow cosmological principles, even as they adapt to modern needs.

Spatial Transformation Based on the Hulu-Teben Concept

The Hulu–Teben concept represents a fundamental cosmological principle underlying spatial organization in traditional Balinese settlements. It classifies space according to sacred and profane orientations associated with the mountain (*kaja*) and the sea (*kelod*). Within this framework, areas oriented toward the mountain (*hulu*) are considered sacred, while areas oriented toward the sea (*teben*) are regarded as profane and associated with everyday domestic activities (Adiputra et al., 2016; Parimin, 1986).

In traditional houses of Bayung Gede Village, this concept is reflected in the arrangement of spatial elements within the *karang umah* compound. Sacred elements, such as the *sanggah*, are typically located in the *hulu* (*kaja*-oriented) area, whereas domestic spaces including the *paon* (kitchen), *jineng* (rice storage), and other activity spaces are positioned in the *teben* (*kelod*-oriented) zone. This configuration demonstrates that spatial organization is not solely determined by functional considerations but also embodies the cosmological values of Balinese society (Parimin, 1986).

Analysis of the sample houses (RW1, RW3, RW4, RW8, RJ4, and RJ5) indicates that most spatial transformations occur within the *teben* zone, which corresponds to the profane domain of the compound. These transformations include the addition of bathrooms and wells in RW1, the conversion of residential space into a *warung* in RW3, the addition of kitchens in RW4 and RJ4, the introduction of a

multi-purpose space in RW8, and the addition of storage space in RJ5. These findings suggest that spatial changes are predominantly concentrated in domestic areas.

This pattern indicates that spatial transformation in traditional houses occurs selectively, primarily within spaces associated with profane or everyday functions. In contrast, sacred elements particularly the *sanggah* remain preserved in their original positions within the spatial structure. This demonstrates that despite ongoing changes, the community continues to maintain cosmological principles as the basis of spatial organization.

These findings are consistent with vernacular architecture theory, which suggests that spatial transformation in traditional buildings generally occurs through gradual adaptation without altering the core structural framework (Rahmi & Setiawan, 2017). In the context of Bayung Gede, transformations are largely driven by domestic needs and economic considerations, and therefore tend to take place in the *teben* zone, which is cosmologically more flexible.

Thus, spatial transformation in traditional houses in Bayung Gede can be understood as a form of adaptive change that continues to respect traditional cosmological principles. Sacred spatial structures are preserved, while domestic spaces are modified to accommodate contemporary living needs.



Figure 6. Diagram of spatial transformation patterns based on the Hulu–Teben concept
Source: Rukmana, et.al, 2026

Figure 6 illustrates the zoning of traditional house compounds in Bayung Gede Village based on the Hulu–Teben cosmological framework, dividing space into three main zones: the *hulu* (sacred), central (semi-sacred), and *teben* (profane) zones. This zoning

reflects the Balinese worldview, where spatial orientation represents the relationship between humans, the environment, and religious beliefs (Parimin, 1986; Adiputra et al., 2016).

The *hulu* (sacred) zone contains key elements such as the *sanggah*, *paon*, and *bale pegaman*, which are maintained as part of the traditional spatial structure due to their religious and social significance. The persistence of these elements indicates that spaces associated with cultural identity and spiritual values remain largely unchanged despite evolving housing needs.

In contrast, the central (semi-sacred) zone exhibits the highest intensity of spatial transformation. Various modifications are identified in this zone, including the addition of bathrooms in RW1, the conversion of space into a *warung* in RW3, the introduction of modern kitchens in RW4 and RJ4, and the addition of storage space in RJ5. Furthermore, the emergence of a multi-purpose space in RW8 also occurs within this zone. These findings suggest that the central zone functions as a transitional space that accommodates adjustments between traditional spatial structures and contemporary living requirements.

Meanwhile, in the *teben* (profane) zone, elements such as the *jineng* generally remain in their original positions and continue to function as agricultural storage spaces, indicating a relatively stable spatial role despite broader transformations.

Overall, these findings demonstrate that spatial transformations in traditional houses in Bayung Gede do not occur randomly but follow the zoning logic of the *Hulu–Teben* concept. Changes tend to occur in zones with higher functional flexibility particularly the central zone while the *hulu* zone remains preserved due to its sacred significance. This aligns with vernacular architecture theory, which emphasizes that transformations in traditional buildings are typically selective and occur without disrupting core cultural structures (Rapoport, 1969; Rahmi & Setiawan, 2017).

Furthermore, this study highlights that spatial transformation is not solely driven by functional needs but also occurs within the framework of cosmological values. Unlike previous studies that focus on settlement-scale morphological changes (Pangasih & Asvitasari, 2016), this research demonstrates that at the dwelling scale, spatial transformations are more localized and adaptive to occupants' needs. These findings reinforce the idea that spatial changes are not uniformly distributed throughout the house but are structured according to the *Hulu–Teben* zoning system, where profane zones exhibit greater flexibility while sacred zones remain preserved.

Socio-Cultural Interpretation of Spatial Transformation

Spatial transformations in traditional houses in Bayung Gede Village are not solely driven by functional needs but are also closely related to the social, economic, and cultural dynamics of the community. The analysis indicates that most changes are concentrated in the *teben* zone, which, within the cosmological framework, is considered profane and more flexible in accommodating functional modifications.

From a socio-psychological perspective, the *teben* zone represents a space that is more open to everyday activities and is not subject to strict sacred constraints. In the Balinese spatial cosmology system, the distinction between sacred and profane spaces is not only physical but also shapes how people perceive and use space (Parimin, 1986; Adiputra et al., 2016). Consequently, profane spaces are more susceptible to change because they are not directly tied to religious values. This finding aligns with vernacular architecture studies suggesting that spatial flexibility is strongly influenced by the cultural meanings embedded within space (Vellinga, 2011).

In addition to cultural factors, economic pressures also play a significant role in driving spatial transformation. In several sample houses, such as RW3, the conversion of residential space into a *warung* illustrates a shift from purely residential use to income-generating functions. In vernacular contexts, houses often evolve beyond their role as dwellings to become spaces that support household economic activities (Oliver, 2006; Tipple, 2000; Kellett, 1993). This indicates that economic demands can encourage flexibility in spatial organization, as long as sacred elements remain intact.

Spatial transformation is also associated with rising living standards and changing patterns of household activities. The addition of utility spaces and the expansion of domestic areas reflect increasing expectations of comfort as well as adaptation to modern technologies and lifestyles. In this regard, spatial change can be understood as part of an ongoing adaptive process responding to broader social development (Rapoport, 2005; Lawrence, 2012; Bahramifar et al., 2022). Although this study does not specifically examine generational differences, the observed transformations suggest a growing tendency toward modern housing needs, which may be associated with shifts in lifestyle and user preferences.

Furthermore, spatial transformation can be linked to broader economic dynamics, including the potential influence of tourism development in the Kintamani region. While not the primary focus of this study, the presence of economic activities such as *warung* indicates that traditional houses are beginning to respond to emerging economic opportunities. This suggests that spatial transformation is not only internally driven but also influenced by external factors that shape functional changes within the house.

Overall, spatial transformations in traditional houses in Bayung Gede Village demonstrate an interaction between cosmological values and practical needs. Changes do not occur arbitrarily but are constrained by cultural norms that regulate spatial organization. This highlights the adaptive nature of traditional architecture, which allows transformation to occur without compromising its cultural identity. Based on the overall findings, spatial transformation in traditional houses can be understood as a process that extends beyond physical modification, involving the interplay between cultural values and spatial cosmology. The observed changes reflect a balance between modern demands and the preservation of traditional spatial principles.

The main contribution of this study lies in the integration of transformation patterns and levels within the *Hulu-Teben* cosmological framework. This approach demonstrates that spatial transformation does not occur randomly but follows a hierarchical and adaptive spatial structure. These findings contribute to vernacular architecture studies by providing a more nuanced understanding of how traditional houses adapt at the dwelling scale while maintaining their cultural identity.

4. Conclusion

This study concludes that traditional houses in Bayung Gede Village have undergone spatial transformations as a form of adaptation to evolving housing needs, domestic activities, and socio-economic conditions. These transformations can be categorized into four main patterns: utility addition, domestic expansion, functional transformation, and activity-based adaptation. Despite these changes, the fundamental spatial structure comprising elements such as the *sanggah*, *bale pegaman*, *paon*, and *jineng* remains preserved. This indicates that spatial transformation does not diminish the identity of traditional architecture but represents a gradual adaptive process.

From the perspective of the *Hulu-Teben* concept, spatial transformations tend to occur within the *teben* zone, which is profane and more flexible in accommodating functional changes, while the *hulu*

zone, which holds sacred value, remains preserved. This demonstrates that spatial transformation in traditional houses in Bayung Gede occurs selectively and continues to be guided by Balinese spatial cosmology. Thus, these houses exhibit a strong adaptive capacity in responding to contemporary needs without losing their cultural values and spatial identity.

Furthermore, based on the classification of transformation levels, changes can be distinguished into three categories: minor, moderate, and major. Minor transformations generally involve the addition of utility spaces with minimal intervention and no impact on the core spatial structure. Moderate transformations occur in domestic areas—such as kitchens and activity spaces—through expansion while maintaining the traditional layout. Major transformations involve significant functional shifts, such as the integration of economic activities within residential spaces. This classification highlights that spatial transformation varies not only in form but also in the degree of intervention within the traditional spatial system.

Overall, spatial transformation in traditional houses in Bayung Gede can be understood as a layered and progressive adaptive process, encompassing both transformation patterns and levels. These findings reinforce the notion that traditional houses are not static but dynamic, capable of adapting to modern needs while preserving the underlying principles of spatial cosmology. The implications of this study suggest that understanding transformation patterns and levels can inform adaptive conservation strategies for traditional architecture, particularly in responding to modernization and socio-economic pressures. A cosmology-based approach, such as the *Hulu-Teben* concept, can serve as a guiding framework for spatial interventions that maintain cultural values while accommodating contemporary living needs.

However, this study is limited by the relatively small number of samples and its focus on the dwelling scale. Future research is recommended to expand the scope to a broader settlement level and to further examine the influence of external factors, such as tourism, regional economic changes, and generational dynamics, on spatial transformation in traditional houses.

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