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Typology and Components of Telajakan Subak: A Sustainable Landscape Model in Anggabaya Village, Bali, Indonesia

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Abstract
This study explores the Subak agricultural landscape in Anggabaya Village, Denpasar, Bali, focusing on its role in sustaining socio-cultural, religious, and ecological practies. Central to this research in the Telajakan Subak, examined to identify and classify its typologies and structural components through an architectural framework. Using qualitative methods, the study involves field surveys, spatial documentation, and interviews. The analysis is guided by five architectural principles and function. Findings reveal diverse Subak typologies influenced by irrigation infrastructure, accessibility, and topography, including both organic and constructed models. These results demonstrate that Telajakan Subak serves as a vital model for sustainable landscape management. This research contributes to vernacular landscape architecture and supports integrating traditional systems into modern urban-rural planning, ensuring the resilience of Balinese cultural landscapes amid suburban pressures.

Keywords: *food Security; rice field landscape; Subak; sustainability; Telajakan Subak Landscape*

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1. INTRODUCTION

Subak, a traditional irrigation system that utilizes the water movement from upstream sources, is divided into downstream rice fields. The word *'suwak'* is considered the modern form of the word *'suwak'* that comes from two words, namely *'su'*, which means good and '*wak', which* means watering. Thus, *subak* can be interpreted as a good irrigation system (Mulyati, 2019). Waterlogged rice fields are made in such a way as to utilize land topography to produce a very beautiful and natural rice field landscape. This also led to *Subak,* with its philosophy and beauty, receiving recognition as a UNESCO World Heritage Site in 2012 (Norken et al., 2016). This recognition has enhanced Subak's presence and made it very famous in Indonesia and worldwide. Although very well known, some observers and researchers of *Subak* are concerned about its sustainability in the future, including the problems noted by (Suanda et al., 2010) that old wooden irrigation buildings need to be replaced with sturdier materials. The longer the decrease in irrigation water, the greater the implications for rice production per unit area (Yuliana et al., 2019). The increase in population and the demands for a more viable livelihood have encouraged people to continue striving to meet all

their needs, with a negative impact on river water and the environment (Eryani & Jayantari, 2019). Increased water demand and high levels of water pollution (Chapagain et al., 2022). Reduced interest of the younger generation to work in agriculture and decreased agricultural land due to land conversion to non-agricultural use (Wahyuni et al., 2023). The problem of subak in cities is more pronounced, such as the change in the function of the rice field (*subak*) for housing, commercial, and tourism uses, and so forth (Norken, 2019).

On the other hand, the existence of *Subak,* which irrigates rice fields, has significant benefits for farmers' welfare. *Subak* carries traditional ecological knowledge, encompassing the physical, natural, and cultural aspects of human interaction with the environment (Zen et al., 2024). *Subak* can maintain its sustainability *by* using non-rice agricultural products for religious ceremonies within *Subak* itself. According to (Windia et al., 2015), in addition to functioning as an irrigation system, *Subak* also has four functions, namely the irrigation distribution function, irrigation canal maintenance function, resource function, conflict solution function, and ritual function. Farmers often use these results to strengthen kinship relations among families, farmers, and communities within the village by simply distributing agricultural products through *Subak*. These agricultural products are plantation crops, such as coconuts, jackfruit, bananas, and sugarcane. According to Ardana et al. (2024), preserving traditional rice varieties and indigenous crops is crucial for conserving genetic diversity and enhancing ecosystem resilience. Agricultural products in *Subak* do not necessarily translate into economic value; rather, they serve as a tool for strengthening social relations in the community. They are used in every ceremonial activity and in socio-religious values in *Subak* itself and the village. According to (Murniti & Marselinawati, 2023), the *Subak* ceremony consists of two ceremonies, namely ceremonies carried out in groups and ceremonies carried out individually. Ceremonial activities certainly require prayer facilities taken from the rice fields themselves. This is reflected in the lives of traditional farming families, who engage in farming, practice quiet activities, are full of peace, and exhibit solidarity (Nerawati, 2020).

Subak comprises several landscape components, namely forests, terraced paddy landscape, rice fields, villages, and temples (Sutomo et al., 2021). Plantation crops are produced using the edges of rice fields, which are usually surrounded by rice fields, or what some farmers call rice fields. Rice fields have also served as protective areas, windbreaks, boundary areas, and barriers between buildings in *Subak*. Exemplifying the function of the rice field requires a more in-depth exploration to determine its typology, arrangement, pattern, and function. So that it can contribute to increasing the value and existence of *Subak,* whose existence needs attention and protection now and in the future, the study was conducted in *Subak* Anggabaya, on the outskirts of Denpasar. This location was chosen with considerations including *that Subak* Anggabaya is still sustainable and has survived the conversion of rice fields in Denpasar City; that *Subak* Anggabaya is located within the traditional village of Anggabaya, which still utilizes plantation products in the *Subak* area for religious ceremonies; and that the community's social system is still powerful. In addition, *Subak* Anggabaya has a *Subak* organization that regulates matters related to food crop farming and flower plant patterns for the benefit of ceremonies, fisheries, animal husbandry, and agrotourism (Kohdrata & Sutrisna, 2011). This consideration makes *Subak's* relationship with the people in Anggabaya Village unique. Research indicates that subak forests are not merely areas covered in vegetation but also play a vital role in the sustainability of subak. This can be an innovative way to maintain their existence despite changes in function.

2. METHODS

The research was conducted in Subak Anggabaya, Anggabaya Village, East Denpasar District, Denpasar City. This research uses a survey method with a qualitative approach. The research was carried out in several stages, namely, collecting field data through field observations to determine the existing condition of Subak Anggabaya. Observation activities include measurements, aerial photography, field sketches,

and interviews with farmers, *Kelian Subak*, and the Anggabaya traditional chairman, called Bendesa. Interviews were conducted to obtain relevant information about explaining the name and function of each element forming the model. The following process is the analysis stage. Researchers process data by modelling Subak's Telajakan conditions and then using interview data to support typological analysis to determine the functions and constituent components. Analysis techniques are carried out with an approach of 5 (five) determining elements of an architecture, which include form, structure, construction, materials, and function. The research procedure involved data collection through observation, aerial photography, sketches, and note-taking. The data collected included the constituent elements, their composition and arrangement, structure and materials, and the function of the *telajakan*. To obtain a more in-depth explanation, interviews were conducted with the *Kelian Subak*. The data obtained were then discussed using a landscape sustainability approach. The analysis technique also uses comparative studies, which are part of the descriptive method, as a medium to examine the example of Anggabaya Subak, which is associated with socio-religious values.

3. RESULT AND DISCUSSION

3.1 Spread of Subak Anggabaya *Telajakan*

According to (Kato et al., 2019), the settlement model is an open space outside the yard wall that is still in ownership that has a spiritual function, cultural function, economic function, communicative function and ecological function. In relation to the example of *Subak,* based on field observations, farmers also say that Subak has an example known as *Telajakan Subak*. In general, *telajakan* is part of the green open land around the settlement, located on the main road or village road in front of, beside, or behind the yard of the house, including the road itself, sewer and drainage, yard, and others (Purba et al., 2020). *Telajakan Subak* is an area of land outside wetland agricultural land that surrounds several rice plots located close to farm roads and irrigation canals that are always adjacent to rice fields. Suppose it is related to the definition of *Telajakan* settlement. In that case, it will be slightly different because there is no physical barrier in the form of a wall, but a barrier regarding land function. *Telajakan* function *Subak* is usually used to plant trees with a header character that does not spread, so they do not shade rice plants planted under them. Based on the *Telajakan Subak* definition, the example distribution can be produced in *Subak* Anggabaya, as shown in Figure 1. *Subak* Anggabaya is scattered throughout the rice field area and divides it into sections related to the farm business road and access for supporting activities. The western side of *Subak* Anggabaya (code 1) is limited by the flow of rivers or *Subak* irrigation flows. The left side of *Subak* (code 2) is the outlet for irrigation water for rice plots extending southward from *Subak*. The middle part is an example of *Subak* adjacent to the farm road. *Subak* is also alongside the irrigation canal to the rice field plot/inlet.

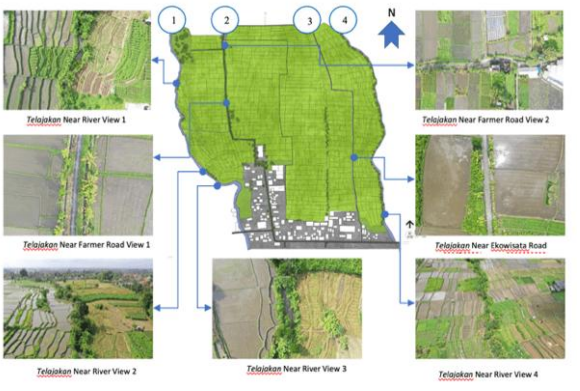


Figure 1. Distribution of *Telajakan Subak* Anggabaya

The *Telajakan* ecotourism road (code 3) is an ecotourism-supporting road adjacent to irrigation canals that serve as outlets and inlets for rice fields. The eastern river (code 4) is an example of a river that becomes the estuary or outlet of the rice fields.

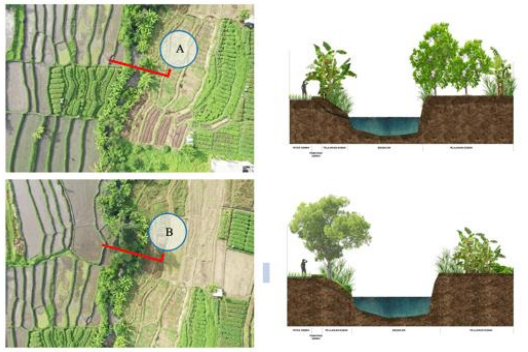
3.2 Typology of Subak Anggabaya

According to (Damayanti et al., 2017), typology is a science that studies the grouping of objects as models through similarities in shape and structure of an object and creatures in general. Based on field observations, the typology will be explained in terms of form, structure, construction, constituent materials, and functions. The distribution of the *Telajakan* is shown in Figure 2.

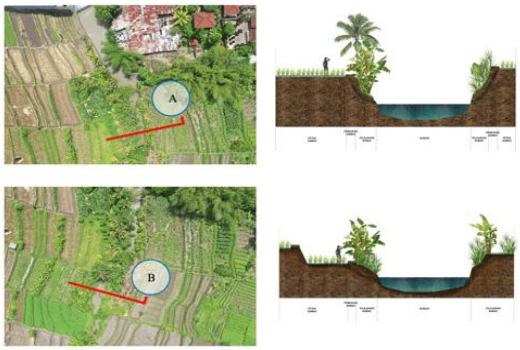
The typology of *Telajakan Subak* Anggabaya can be explained as follows:

Figure 2. Spread of *Subak Telajakan*

The terrace near the west river (numbers 1 and 4) is an estuary in the lowest land position, so it becomes the estuary of the water flow in the eastern rice fields. Physically, the type of *Subak* exemption can be seen in Figure 3 of the *Subak* Telajakan arrangement, explained as follows:



Detail 1



Detail 4

Figure 3. Details of Area Number 1 (Up) and Number 4 (Down)

The shape of the longitudinal *telajakan* follows the river's flow. Telajakan is between the rivers that form the river border. The width of the *Subak* section varies between 50 cm and 300 cm. Stand side by side with a path or a rice field, with a minimum width of 40 cm. *Telajakan* is directly related to the river's wall or bank. The dominant river is formed semi-naturally, and it exhibits considerable variation in shape and dimensions. The *Telajakan* structure is a layer of clay overgrown with weeds and productive trees. *Telajakan* construction is arranged around clay as a planting medium, with stands of tree vegetation, shrubs, and ground cover. The presence of plants on the terrace serves as a binder for the surface and deep soil, so that when rainfall or river water conditions are high, the soil is less easily eroded or erosion is less severe. The constituent materials consist of rice field paths, outlet irrigation canals, and productive crops such as *Cocos nucifera* L., *Musa paradisiaca*, and *Schizostachyum zollingeri*. Shrub plants are predominantly *Pennisetum purpureum* and other shrub plants that grow wildly. The functions of *Telajakan* products are food crop production, protection against erosion, breaking wind movement in tree stands, providing animal habitats, and enabling farmers' access to other rice plot areas. During the rainy season, when the river water overflows, the tree stand on the terrace protects against garbage carried by the river flow, so that the rice plots are protected. The arrangement of plants varies with clustered and random plant patterns. The masked grouping is a pattern of planting trees in rows, such as banana and bamboo groups. Some plants are deliberately planted in *telajakan,* including bananas, coconuts, *waru*, and elephant grass.

The ecotourism road and business road (numbers 2 and 3). The *Telajakan* picture is shown in Figure 4. The shape of the longitudinal *telajakan* follows the path of farming. *Telajakan* is located between tertiary water networks, with an inlet network. *Telajakan* has a width of 70-300 cm. A *Telajakan* element of the artificial landscape is the same size. *Telajakan* separates two tertiary water networks, both the water that enters the rice plot and the irrigation networks that drain other rice plots. The *Telajakan* structure is a layer of clay and soil retaining walls composed of stone and concrete. The *Telajakan* is constructed of clay, with stands

of plants, including trees, shrubs, and ground cover that grow naturally. Some *Telajakan* wall constructions are made with permanent pavement because they anticipate the collapse of *Telajakan* soil, which could cause closure or disruption of water distribution.

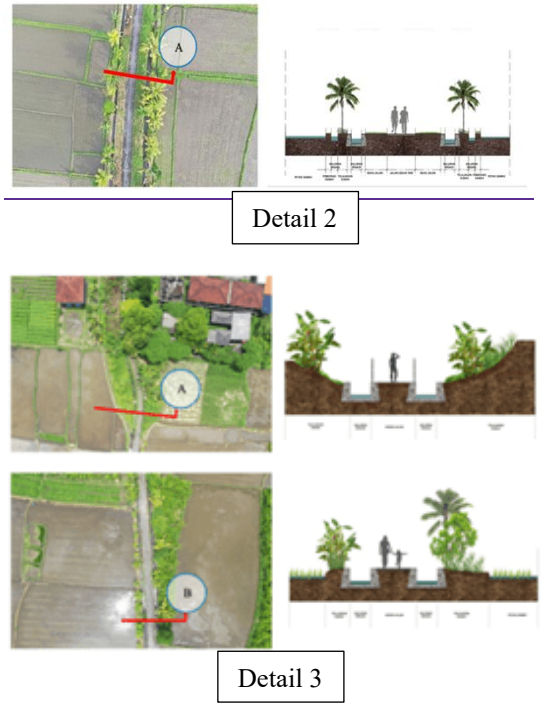


Figure 4. Details of Area Number 2 (Up) and Number 3 (Down)

The constituent material comprises inlet irrigation networks and productive crops such as *Cocos nucifera* L., *Musa paradisiaca*, and *Schizostachyum zollingeri*. Shrub plants consist of *Pennisetum purpureum*, *Cordyline terminalis,* and others. Ground cover is a plant that grows wildly. The arrangement of plants on this terrace is planned but random because the path is often traveled, so the condition is kept well-maintained. The function of *Telajakan* products is to produce food crops, provide vision and direction, enhance aesthetics, and perform ecological functions, such as breaking wind movements, protecting animals that enter rice fields and animal habitats, and monitoring.

3.3 Pattern of Subak Anggabaya

Based on field observations, the typology will be explained in terms of form, structure, construction, constituent materials, and functions. The typology of *Telajakan Subak* Anggabaya can be described as follows: based on the observation and data processing from the identification of the *Telajakan Subak Anggabaya*, based on an analysis approach of 5 (five) determining elements of an architecture, it was found that the repetition of the illustrative composition has almost the same characteristics. There are differences in composition among these similarities, but they are not significantly visible. Based on the four *Telajakan* locations obtained, the pattern of *Telajakan Subak* Anggabaya can be explained through the following picture (Figure 5):

Subak exemption patterns 1 and 4 are examples close to the river. The pattern extends along the river on the left and right sides. The shape of the torture follows the shape of the river's body, so its natural shape follows the natural form of the river. The invitation width ranges from 50 cm to 400 cm. The greater the torture, the more plants grow and are productive crops for food, ceremonial, and economic functions. *Telajakan* is adjacent to the rice field road, and an outlet channel from the rice field plot to the river runs through the field. The example includes part of the river boundary to vary the slope. The wider the river is reflected, the wider the *Subak Telajakan*. Plant composition tends to be variegated, with trees exhibiting random patterns, but each type tends to group—plants grouped by the intercropping system.

Subak Telajakan patterns 2 and 3 are located close to the farm or the road, both of which can be reached by car and motorcycle. The longitudinal *Telajakan* pattern follows the path. The width of the lamp ranges from 50 cm to 300 cm—the greater the width of the lamp, the more plant composition in the light. Physically, *telajakan* divides two tertiary channels: the channel to the rice field plot/inlet and the other tertiary channels whose flows go to the other *Subak* plot—evidenced by soil-retaining backings made of a mixture of river stone and concrete. This type of landscape is composed of productive plant types and aesthetic supports and seems neater/maintained. The composition of plants is arranged randomly but in groups of each type. Plant types are more dominant, with fewer types than landscape types near rivers. Intercropping systems are scarce due to limited land width.

The landscape pattern near the river, or numbers 1 and 4 in *Subak* Anggabaya, serves as the boundary, or natural boundary, for *Subak*

Anggabaya's management status. This landscape pattern serves as a buffer/boundary for the *Subak* Anggabaya landscape on its east and west sides. This *Telajakan* landscape is at the lowest level of *Subak* Anggabaya, so it is downstream of the water in the rice fields. The Telajakan landscape pattern is close to the accessibility of vehicles and humans, such as numbers 2 and 3 in *Subak* Anggabaya, to support productive road blasphemy areas. *Telajakan Subak* serves as a decorative element and directs the user's gaze. *Telajakan Subak* is in the middle of the *Subak* area. The distribution of the *Subak* landscape, the Telajakan pattern, can be seen in Figure 5.

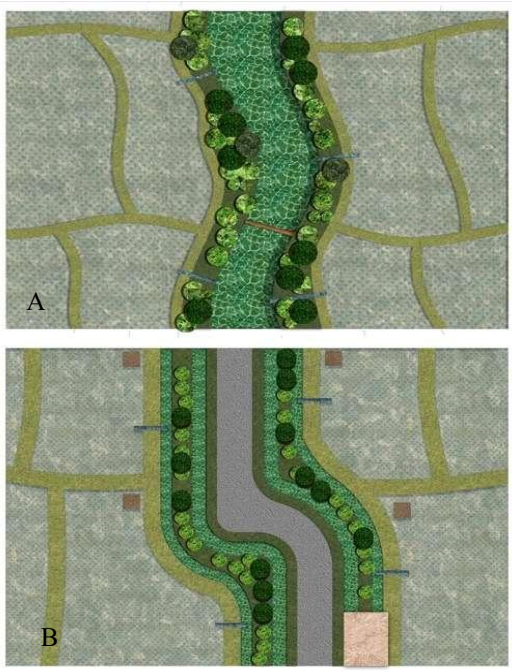


Figure 5. A. Landscape Modeling Pattern Following River Flow (Up) and B. Landscape Modeling Pattern Following Farm Road Path (Down)

Looking at the typology and pattern of *Telajakan* and based on interviews with farmers and the surrounding community, the functions of *Telajakan Subak* Anggabaya include:

a. Food function: plants that grow are laid down primarily to serve as a feed source or to be consumed. Based on (Suasih, N.N.R., Budhi, M.K.S., Yasa, I N.M., 2018), for the Balinese, agriculture (especially lowland rice) has become a cultural root (way of life). This aligns with Field's (Pradana, 2023) statement that *subak* traditions are reflected in contributions to food security efforts and in handling conflicts related to traditional agricultural practices.
b. Economic function: after meeting food needs, the crops in the model can be economically productive. Farmers can sell their crops in the market, and people who buy them can do so directly in the *Subak*. This area adds additional economic value beyond the value of crops grown in rice fields. This aligns with the statement by(Sutomo et al., 2021) that plants in the *Subak* area can be used for animal feed, building materials, crafts, and medicine.
c. The social function in the *Telajakan* area is also a building/bale used by farmers to meet, communicate, and socialize, to discuss issues related to *Subak*. In addition, the ceremonies that take place in the *Telajakan* area foster social interaction, which aligns with the statement (Murniti & Marselinawati, 2023).
d. Ecological function: *Subak* provides ecological benefits, including habitat for several animals (e.g., reptiles and birds) and river erosion control. Good water management will have a sustainable impact on the fields of art, economy, culture, and environment (Putra et al., 2023).
e. Spiritual function: on certain days, the *Telajakan* becomes a venue for ritual ceremonies. There is a *pelinggih* in the example as a ceremonial facility. Some plants growing on the pedestal are used for ceremonial purposes. This aligns with the statement by (Murniti & Marselinawati, 2023) that farmers perform ritual ceremonies as a form of Hindu devotion to the Creator. Various ritual activities are cultural practices that symbolize the maintenance of Balinese culture through the application of *Tri Hita Karana* (Windia et al., 2015). In addition, the plants planted are used by farmers to support religious ceremonies. This aligns with (Sutomo et al., 2021). This states that the use of plant species in the subak is primarily to support ceremonial activities.
f. Technical irrigation function: *Telajakan* also serves as a barrier for irrigation canals in rice fields. *Telajakan* can also link tertiary channels from and to rice plots to other channels. In addition, the *telajakan* also

functions as an access barrier through irrigation canals between rice plots.

g. Disaster mitigation: serves as a refuge from flooding during heavy rainfall. Trees along the *Subak* can drive river water materials into the rice fields. Avoid attracting wild animals that could damage rice yields. Exemplify with wild plants that naturally host several animals, such as snakes and monitor lizards, thereby indirectly controlling rat pests. The function of *Subak goes* beyond farmers' understanding, highlighting its potential as an urban green open space, a vital source of food, and a pivotal area for rainwater catchment to prevent floods (Rusadi, 2024). These functions are among the reasons why *Telajakan Subak* exists today as a means of Subak's sustainability.

4. CONCLUSION

The typology of *Subak* exemptions is classified as a naturally formed model and an artificially formed *Telajakan*. *Telajakan Subak* has an elongated shape, following the river's flow and accessibility. The terrace width tends to vary, with the oldest terrace near the river. Near accessibility tends to be a consistent width only in a few wider places. The structure consists of clay components, pavement as erosion protection, and productive plant stands. The terrace is a clay mound that, in a crucial area, has soil-retaining walls and irrigation buildings. The constituent materials are productive trees and shrubs and ground cover that grow wildly; there are inlet and/or outlet irrigation buildings, *pelinggih*, rice paddy ripens, and social function bales. *Telajakan* functions are food, economic, social, ecological, spiritual, irrigation, and disaster mitigation. The *Telajakan* pattern continues to define the *Subak* area and simultaneously creates a buffer area by the stand of the plant pattern. At the same time, other *Telajakan* landscape patterns support productive and well-maintained road blasphemy areas. Factors that influence typology and *Telajakan* patterns include land topography, the width and depth of rivers, and the addition of *Subak* area functions such as tourism and recreation.

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