

# Maintain the Economic Activity of Subak in Social and Environmental Transformation

I Gusti Ayu Purnamawati<sup>1\*</sup>, Gede Adi Yuniarta<sup>2</sup>, Putu Ria Astria<sup>3</sup> Lucy Sri Musmini<sup>4</sup>

<sup>1,2,3,4</sup>Universitas Pendidikan Ganesha, Singaraja-Indonesia

## ARTICLE INFO

### Article history:

Received December 11, 2022

Received in revised form December 24, 2022

Accepted December 24, 2022

Available online December 31, 2022

### Kata Kunci:

Ekonomi berkelanjutan, irigasi tradisional, modal sosial.

### Keywords:

Sustainable economy, social capital, traditional irrigation.

## ABSTRAK

Penelitian ini bertujuan untuk mengetahui pengaruh keberlanjutan ekonomi dan modal sosial terhadap keberlanjutan pengelolaan irigasi tradisional di Bali. Metode penelitian kuantitatif ini menggunakan data primer yang diperoleh dari data kuesioner dan diukur dengan skala Likert. Populasi penelitian ini adalah anggota subak yang ada di Provinsi Bali sebanyak 2.726 orang, dan sampel penelitian diperoleh sampel sebanyak 348 orang. Kuesioner sebagai data penelitian yang dikumpulkan dan dibagikan kepada setiap anggota subak dan teknik statistik atau analisis data dalam penelitian dianggap menggunakan Structural Equation Model (SEM) dengan pemodelan perangkat lunak WarpPLS 7.0. Hasil penelitian ini menunjukkan bahwa keberlangsungan ekonomi dan modal sosial berpengaruh positif dan signifikan terhadap keberlangsungan pengelolaan irigasi tradisional di Bali.

## ABSTRACT

This study aimed to determine the effect of economic sustainability and social capital on the sustainability of traditional irrigation management in Bali. This quantitative research method uses primary data obtained from questionnaire data and measured by a Likert scale. The population of this study was 2,726 subak members in the province of Bali, and the research sample obtained a sample of 348 people. Questionnaires, as research data were collected and distributed to each member of the subak and statistical or data analysis techniques in the study, were considered using the Structural Equation Model (SEM) with WarpPLS 7.0 software modeling. The results of this study indicate that economic sustainability and social capital have a positive and significant impact on the sustainability of traditional irrigation management in Bali.

\* Corresponding author.

E-mail: [ayu.purnamawati@undiksha.ac.id](mailto:ayu.purnamawati@undiksha.ac.id) (I Gusti Ayu Purnamawati)

## 1. Introduction

The province of Bali is quite famous for its customs and culture; one of the unique cultural heritages passed down from generation to generation is an irrigation system in traditional villages known as subak. Subak is a collection of communities and organizations from local traditional village communities with regulations determined by the village awig-awig. Subak historically continues to grow and develop, where this organization is connected to socio-agricultural and religious organizations (Hutasoit & Wau, 2017). The role of subak is indeed felt to be quite important for the Balinese people, but unfortunately, the survival of subak amid the globalization era is now a tough job for the Balinese because local wisdom is, of course, increasingly eroded. Subak should use local wisdom as much as possible to maintain food and biological security. Although subak is designated as a world cultural heritage by UNESCO, this should not just be a story later.

Subak is known for its purpose of realizing harmony and togetherness through its foundation based on Tri Hita Karana, which maintains balance with God, with humans, and their environment (Nerawati, 2020). This is the advantage of the water irrigation system in Bali Province compared to irrigation systems in other regions and countries. Indeed, the irrigation system in Bali is the same as the irrigation system in general, such as regulating the allocation and distribution of irrigation water, mobilizing farmers' resources, maintaining irrigation canals, and looking for solutions when conflicts occur, but the difference is that in Bali there are ritual activities where ceremonial activities are carried out. From the beginning of the process to the end. This ceremonial activity is considered a cultural heritage because subak activities can strengthen unity despite the subak group's religious differences and the interest in using water together for their agricultural activities (Wisarja & Suastini, 2022) so that the group is not only concerned with physical factors but also spiritual factors that can reduce conflict.

One example of a subak that maintains a traditional agricultural system is the Jatiluwih Tourism Village, where farmers are not affected by the industrialization world that uses machines in their agricultural system (Rahmi & Setiawan, 2020). This is a positive influence for rural women workers because if they follow the industrialization world, which prefers to use machines, it will decrease the world of work as farmers. The tourist village of Jatiluwih is famous for its beautiful terraces, so the community will be able to continue farming with traditional farming systems and pass down a good and beautiful form of traditional irrigation system in the form of terraces to future generations. Not only the agricultural system is maintained, but the tourism element is also growing, so these two things must be preserved.

Subak as a social institution is one form of culture in terms of ideas and ideas outlined in awig-awig subak. Togetherness, cooperation, and the tri hita Karana are realized in a harmonious relationship in the form of three dimensions, causing Subak to be considered capable of playing a role in preserving the environment and culture (Risna et al., 2020). In addition, a series of ceremonies in the context of ritual activities, both seen from the physical form in the form of rice fields, terraces, irrigation canals, as well as sacred places (subak temples) such as Masceti Temple, Bedugul Temple, causes the role of subak to be able to maintain environmental balance in Bali Province.

Interventions will always come from external parties in preserving the subak so that subaks are expected to adapt to technological developments, understand and adapt to cultural dynamics, implement good governance, and organize more flexible organizational arrangements that adapt to local village environmental conditions. This research is interesting to do considering that there have been many studies on the sustainability of traditional irrigation management in Bali, but the results are still mixed (Purnamawati et al., 2022). This is presumably due to differences in analytical techniques and a direct or indirect relationship with traditional irrigation management variables in Bali.

Stakeholder theory is a theory that explains how companies can meet stakeholder expectations that require disclosure of information related to activities. The company is needed for decision-making. This means that organizations and stakeholders must be related and influence each other to form social relationships that are responsible and accountable. Subak, as a traditional rice field irrigation system in Bali, carries out stakeholder theory by establishing a relationship of trust (Sanica et al., 2019) and respect between subak prajuru, subak manners, the community around the Subak area, and the government so that it is not only concerned with economic aspects but also socio-cultural aspects. Also included in it. For (Casciarri & Aken, 2013), water is a very important element that connects all aspects. (Utami & Oue, 2022) In understanding a community's culture, it is very important to determine the sustainability of a natural resource, such as water resources, where traditional methods can adapt to the ecological environment in which they live. It is also useful in conserving, managing, and sustainable use of natural resources because it can establish relationships between humans and the environment.

Subak, an organization with a traditional irrigation system in Bali, has characteristics such as a clear separation of boundaries for irrigation arrangements between village administration and subak

administration (Huang, 2019), autonomous rights in regulating their work activities and having clear duties in their respective fields of work. , the existence of religious rituals in the implementation of activities, having one or more springs which are obtained from empelan/weir, springs and seepage from the subak above it, each subak irrigation system has a characteristic where each expanse of rice fields cultivated by subak members has a trough of cultivation where it enters. Water supply and borrowing of water outlets or places where excess water is discharged individually, as well as decision-making in subak in the management of irrigation systems, is carried out in a democratic, fair, transparent, and accountable manner.

Previously, the subak system was used only to manage irrigation water to benefit its subak members in irrigating their rice fields. Over time, the current subak system carries out economic activities that require organizational financial management (Sedana et al., 2021). Money managed by subaks generally includes contributions from active and passive subak members, fines levied from subak members when committing violations, and rice fields. This financial management is, of course, expected to improve the welfare of the members of the subak, which further strengthens the empowerment of the subak to manage the irrigation system, which is part of the customary law community.

Subak is related to social capital, which has a philosophical foundation of Tri Hita Karana, which emphasizes balance and harmony, namely balance and harmony between humans and each other, with their natural environment, and with God Almighty as the creator of everything in this universe (Purnamawati, Jie, et al., 2022). This means that subak has enormous potential to play a role as a natural resource manager to support sustainable development. Subak is unique and characteristic of Balinese cultural wisdom in an agricultural concept based on the natural environment and culture. Tri Hita Karana, which includes parhyangan, pawongan and palemahan, can distinguish irrigation systems from others. Parhyangan by carrying out a series of spiritual events from the agricultural process to the harvest, pawongan by compiling an organizational structure and the existence of awig-awig to maintain harmony among fellow subak manners, and palemahan by maintaining irrigation channels and making rice fields without destroying the contours of the land (Risna et al., 2020). Just like with other organizations, subak is equipped and strengthened by the existence of social norms called awig-awig. Awig-awig is said to be the glue of members where there are things that must be carried out and those that are prohibited. So that the social values contained can improve the quality of farmers and the environment. In addition, it is said that awig-awig is a tool for controlling the behavior of subak members in maintaining harmony, order, and security that can realize the sustainability and sustainability of subak. The subak system has long been known for its fair distribution of harvests, controllable pest attacks, and participatory problem-solving by holding regular meetings (Limpo et al., 2022).

Based on the presentation, the hypotheses formulated are:

H1: Economic sustainability affects the sustainability of traditional irrigation management

H2: Social capital affects the sustainability of traditional irrigation management

## **2. Method**

Quantitative research is used in this type of research based on a certain population or sample. The data collection technique was distributing questionnaires to each subak spread across the province of Bali. The questionnaire is related to three variables, namely economic sustainability, social capital, and the sustainability of traditional irrigation management, and uses a Likert scale of 1-5 points. The population in the study was 2,726 (Dinas Kebudayaan Provinsi Bali, 2018), and the sampling technique used a random sampling sample determined by the slovin formula with a margin of error of 5%, so the sample obtained was  $n = (2.726 / (1 + 2.726)) * 0.052 = 348$ . The study's data or statistical analysis techniques were considered using Structural Equation Model with modeling software WarpPLS 7.0.

## **3. Results and Discussion**

The outer model tests the validity and reliability of a research instrument. The validity test in the outer model is measured with convergent validity and discriminant validity instruments. Convergent validity determines the correlation between reflective indicator scores and latent variable scores. The criteria for this validity are met if the loading value is 0.6.

**Table 1.** Convergent Validity

Variable	Indicator	X1	X2	Y	P-value*
Sustainability Economics (X1)	X1.1	0.882*	0.085	-0.340	<0.001
	X1.2	0.858*	0.029	-0.124	<0.001
	X1.3	0.789*	0.003	0.192	<0.001
	X1.4	0.832*	-0.077	0.096	<0.001
Social Capital (X2)	X2.1	0.420	0.743*	0.173	<0.001
	X2.2	-0.068	0.910*	-0.262	<0.001
	X2.3	-0.174	0.852*	0.105	<0.001
Sustainability of Traditional Irrigation Management (Y)	Y.1	0.011	0.504	0.688*	<0.001
	Y.2	-0.216	0.194	0.794*	<0.001
	Y.3	0.383	-0.190	0.758*	<0.001
	Y.4	0.008	-0.141	0.802*	<0.001
	Y.5	-0.316	-0.028	0.841*	<0.001

Source: processed data

\*P-value = <0.001 (Valid)

Table 1 shows that the value of combined loadings and cross-loadings in the convergent validity test has a loading value of 0.6, meaning that it has met the criteria so that the validity is met. For discriminant validity, validity is met if the cross-loading value of each indicator on the relevant variable is greater than the cross-loadings of other latent variables. The table below shows that the AVE value of each variable from 348 respondents is greater than the correlation between latent variables in the same column. This shows that discriminant validity can be accepted.

**Table 2.** Discriminant validity

<i>Correlations among l.vs. With sq. rts. of AVEs</i>			
	X1	X2	X3
Sustainable Economics (X1)	0.649*	0.378	0.557
Social Capital (X2)	0.378	0.704*	0.538
Irrigation Management Sustainability (Y)	0.557	0.538	0.601*

Source: processed data

The questionnaire has high composite reliability if the composite reliability value 0.8. At the same time, Cronbach's alpha on each variable must have a value above 0.6. In table 3, the composite reliability value of each variable is above 0.7, and Cronbach's alpha value of each variable is above 0.6, so it can be concluded that all variables have met the reliability criteria.

**Table 3.** Latent variable coefficients

	X1	X2	Y
R-squared coefficients			0,754
Adjusted R-squared coefficients			0,706
Composite reliability coefficients	0,738	0,744	0,734
Cronbach's alpha coefficients	0,730	0,796	0,761
Average variances extracted	0,421	0,496	0,361
Full collinearity VIFs	1,468	1,426	1,771
Q-squared coefficients			0,454

Source: processed data

Furthermore, table 3 obtained information in the form of R-square in the study of 0.754, which means 75.4% of the sustainability variable of traditional irrigation management in Bali can be explained by two variables: sustainability economic variables and social capital, while another variable influence the remaining 24.6%. In the value of full collinearity VIFs, the criteria must be smaller than (< 3.3) so that it can be stated that the model is free from vertical collinearity problems and there is a common method bias; the

output results show a value less than ( $< 3.3$ ) then the value of full collinearity VIFs are accepted. In the measurement of Q-square coefficients used as an assessment of predictive validity, which can be negative and have a value greater than ( $> 0$ ), the results of the study show a value greater than ( $> 0$ ) so that it is declared valid.

The research is declared good if the structural model meets the required standards (Kock, 2015). Table 4 shows test items and standard test values of the inner model used in measuring the strength of the model.

**Table 4.** Model Fit and Quality Indices

Model Fit and Quality Indices	Criteria Fit	Index*
Average path coefficient	$p < 0.05$	0,410
Average R-squared	$p < 0.05$	0,459
Average adjusted R-squared	$p < 0.05$	0,456
Average block VIF	acceptable if $\leq 5$ , ideally $\leq 3.3$	2,555
Average full collinearity VIF	acceptable if $\leq 5$ , ideally $\leq 3.3$	2,245
Tenenhaus GoF	small $\geq 0.1$ , medium $\geq 0.25$ , large $\geq 0.36$	0,442
Sympson's paradox ratio	acceptable if $\geq 0.7$ , ideally = 1	1,0
R-squared contribution ratio	acceptable if $\geq 0.9$ , ideally = 1	1,0
Statistical suppression ratio	acceptable if $\geq 0.7$	1,0
Nonlinear bivariate causality direction ratio	acceptable if $\geq 0.7$	1,000

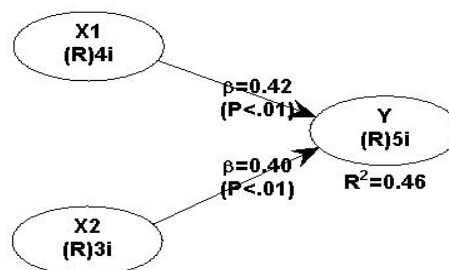
Source: processed data

(\* = Fulfilled)

The output results presented in table 4 show the fit and quality indices models for all criteria for the values of APC, ARS, AARS, AVIF, AFVIF, GoF, SPR, RSCR, SSR to NLBCDR have met the criteria so that the structural model can be accepted and can be used as analysis.

Furthermore, Figure 1 shows a direct relationship between the variables studied. At the same time, table 5 output results in the form of path coefficient values are used to determine the magnitude of the direct relationship effect. The results of the direct influence test in this study which are shown in Figure 1 and Table 5, are interpreted as follows:

1. The value of path coefficients from sustainability economics to traditional irrigation management sustainability in Bali is 0.417, and p-values are  $0.001 < 0.05$  significance level, it is stated that sustainability economics has a significant effect on the sustainability of traditional irrigation management in Bali.
2. The value of path coefficients from social capital towards the sustainability of traditional irrigation management in Bali is 0.403, and the p-values are  $0.001 < 0.05$  significance level, it is stated that economic sustainability has a significant effect on the sustainability of traditional irrigation management in Bali.



**Figure 1.** Result of direct effect analysis

**Table 5.** Path Coefficients

Variable	Criteria	
	Path coefficients	P Values
Sustainability Economics (X1)	0,417	< 0,001***
Social Capital (X2)	0,403	< 0,001***

Source: processed data

(\*\*\* = significant)

The study results show that the first hypothesis is accepted, which means that economic sustainability has a significant effect on the sustainability of traditional irrigation management in Bali. This research is in line with what was stated by (Mikhno et al., 2021); (Khoshnava et al., 2019); (Suardi et al., 2022) that the subak irrigation system in Bali must be maintained and preserved, which can be done by implementing sustainability for rice fields in Bali. Sustainability in maintaining water resources, boundaries between subaks must be clearer, a flexible subak organizational system that adapts to local customs, and harmony and togetherness by the Tri Hita Karana concept that underlies the subak irrigation system institution. In preserving the subak area, agro-tourism areas can be developed and empowered. Agrotourism attempts to place the primary sector (agriculture) in the tertiary sector (tourism). This certainly makes the agricultural sector more advanced, so the government is expected to balance the agricultural sector, subak, and tourism sectors. In addition to the provision of agro-tourism areas, subak conservation efforts can also be carried out by procuring jogging track facilities where this is also related to tourism so that the jogging track must be equipped with natural beauty so that it is not only used for sports but can make road access for farmers to facilitate their work activities.

Furthermore, the results of the next study indicate that the second hypothesis is accepted, which means that social capital significantly affects the sustainability of traditional irrigation management in Bali. Based on originality, uniqueness, and globally accepted values, subak is said to be able to reflect humanity and provide welfare for the community (Norken et al., 2017). In addition, subak is also said to be a reflection of noble values that are universal and very relevant in the implementation of sustainable development, which can preserve socio-cultural values in rural areas and improve the tourism sector (Wijayanti et al., 2020). As has been explained, Tri Hita Karana in the subak system is expected to be able to solve problems and anticipate social conflicts regarding water sources. Traditional local wisdom such as subak is one of the cultural heritages that exist in Indonesian society and has been passed down from generation to generation by the concerned community group (Kurnia et al., 2022), explaining that from an environmental point of view, the existence of traditional local wisdom is very beneficial because it directly or indirectly in preserving the environment and preventing environmental damage, especially subak.

#### 4. Conclusion and Suggestion

The research results above have shown that the two independent variables, namely the sustainability economic variable and the social capital variable, significantly affect the sustainability of traditional irrigation management in Bali. Subak has strength in an agricultural culture that has been institutionalized so that it becomes a tradition and integrates with the culture of everyday life. This traditional irrigation in Bali has a basic concept of Tri Hita Karana by emphasizing balance and harmony between humans, God, and the natural environment. This means that Subak has enormous potential by acting as a natural resource manager to support sustainability, especially in the economic field. Even though the subak area is getting narrower in the current era, subak members still try to maintain the optimal implementation of subak activities. The subak area can still be a function of tourism activities to help the economy of the subak members. The limitation in this study lies in the variables used are only two independent variables which include economic sustainability and social capital, so it does not show a role in the sustainability of traditional irrigation management in Bali, besides that the research is only aimed at irrigation in Bali, so it does not represent all existing irrigation In Indonesia.

#### References

- Casciarri, B., & Aken, M. Van. (2013). Anthropologie et eau (x) affaires globales, eaux locales et flux de cultures. *Journal Des Anthropologues. Association Française Des Anthropologues*, 132(133), 15–44.
- Dinas Kebudayaan Provinsi Bali. (2018). *2.726 Subak Berusaha Bertahan*. Nusabali.

- Huang, H. (2019). Nature and the Spirit: Ritual, Environment, and the Subak in Bali. *EnviroLab Asia*, 3(2), 1–23.
- Hutasoit, H., & Wau, R. (2017). Menuju Sustainability dengan Tri Hita Karana (Sebuah Studi Interpretif Pada Masyarakat Bali). *Business Management Journal*, 13(2), 1–10.
- Khoshnava, S. M., Rostami, R., Zin, R. M., Štreimikiene, D., Yousefpour, A., Strielkowski, W., & Mardani, A. (2019). Aligning the Criteria of Green Economy (GE) and Sustainable Development Goals (SDGs) to Implement Sustainable Development. *Sustainability*, 11(4615), 1–23. <https://doi.org/10.3390/su11174615>
- Kock, N. (2015). WarpPLS 5.0 User Manual. *Laredo, TX: ScriptWarp Systems, Texas, USA*.
- Kurnia, G., Setiawan, I., Tridakusumah, A. C., Jaelani, G., Heryanto, M. A., & Nugraha, A. (2022). Local Wisdom for Ensuring Agriculture Sustainability: A Case from Indonesia. *Sustainability*, 14(8823), 1. <https://doi.org/10.3390/su14148823>
- Limpo, S. Y., Fahmid, I. M., Fattah, A., Rauf, A. W., Surmaini, E., Syahbuddin, H., & Andri, K. B. (2022). Integrating Indigenous and Scientific Knowledge for Decision Making of Rice Farming in South Sulawesi, Indonesia. *Sustainability*, 14(5), 1–23. <https://doi.org/10.3390/su14052952>
- Mikhno, I., Koval, V., Shvets, G., Garmatiuk, O., & Tamošiūnienė, R. (2021). GREEN ECONOMY IN SUSTAINABLE DEVELOPMENT AND IMPROVEMENT OF RESOURCE EFFICIENCY. *CENTRAL EUROPEAN BUSINESS REVIEW*, 10(1), 9–113. <https://doi.org/10.18267/j.cebr.252>
- Nerawati, N. G. A. A. (2020). Implementation Of Tri Hita Karana Teachings In Subak Activities In Bali. *Jurnal Penelitian Agama Hindu*, 4(2), 133–140.
- Norken, I. N., Suputra, I. K., Arsana, I. G. N. K., & Ngurah, I. (2017). Institutional and Regulatory Roles in Maintaining Sustainability of Subak as a World Cultural Heritage in Bali. *Asian Agri-History*, 21(4), 245–254.
- Purnamawati, I. G. A., Jie, F., & Hatane, S. E. (2022). Cultural Change Shapes the Sustainable Development of Religious Ecotourism Villages in Bali, Indonesia. *Sustainability*, 14(12), 1–15. <https://doi.org/10.3390/su14127368>
- Purnamawati, I. G. A., Yuniarta, G. A., & Wahyuni, N. K. S. (2022). The Role Analysis of the Physical Environment, Socio-Economic, and the Urgency of Tat Tvam Asi in Collective Resource Management Multicultural Subak. *Asia-Pacific Management and Business Application*, 11(1), 19–36. <https://doi.org/10.21776/ub.apmba.2022.011.012>
- Rahmi, D. H., & Setiawan, B. (2020). Pressures on the Balinese world cultural landscape heritage: The case of Jatiluwih Subak Village. *IOP Conf. Series: Earth and Environmental Science*, 501, 1–9. <https://doi.org/10.1088/1755-1315/501/1/012032>
- Risna, R. A., Rustini, H. A., Herry, Buchori, D., & Pribadi, D. O. (2020). Subak, a Nature-based Solutions Evidence from Indonesia. *IOP Conf. Series: Earth and Environmental Science*, 959(012030), 1–13. <https://doi.org/10.1088/1755-1315/959/1/012030>
- Sanica, I. G., Wiagustini, L. P., SEDANA, I., & ARTINI, N. (2019). Internalization of Intrinsic Value of Trust in Financial Accountability: A Study of Subak Jatiluwih Bali Indonesia. *International Business Research*, 12(1), 99–109.
- Sedana, G., Yastini, N. N., & Maulina, M. I. (2021). Roles of local farmers' organization in supporting food security: case of Subak in Bali, indonesia. *IOP Conference Series: Earth and Environmental Science*, 911(1), 1–10. <https://doi.org/10.1088/1755-1315/911/1/012083>
- Suardi, I. D. P. O., WIDHIANTHINI, ARISENA, G. M. K., SUYARTO, R., & KRISNANDIKA, A. A. K. (2022). Management Policies Implication for the Agricultural Land Conversion Sustainable Control Strategy in Bali Province. *Journal of Environmental Management and Tourism*, 3(59), 721–731. [https://doi.org/10.14505/jemt.v13.3\(59\).12](https://doi.org/10.14505/jemt.v13.3(59).12)
- Utami, A., & Oue, H. (2022). Traditional ecological knowledge in irrigation water management in Tanah Datar District West Sumatera. *IOP Conf. Series: Earth and Environmental Science*, 1059(012036), 1–15. <https://doi.org/10.1088/1755-1315/1059/1/012036>
- Wijayanti, P. U., Windia, W., Darmawan, D. P., & Widhianthini, W. (2020). Sustainable development model of subak in Denpasar City. *International Journal of Life Sciences*, 4(1), 109–117.
- Wisarja, I. K., & Suastini, N. N. (2022). Hindu-Islam Relationship In Bali. *Journal of Positive School Psychology*, 6(3), 8181–8192.