

# SUSTAINABILITY OF SUBAK IRRIGATION SYSTEM IN BALI (Experience of Bali Island)<sup>1</sup>

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## Abstract

Subak is a traditional irrigation system in Bali managed by farmers autonomously. Existence of this irrigation system has been known since 1071 AD and still exists up to these days. It can happen because subak significantly and consistently applies the philosophy adopted namely *Tri Hita Karana* (THK). In day-to-day life, subak conducts some activities like (i) spiritual activities consisting of various religious ceremonies, (ii) mutual assistance activities and its organization is governed by a traditional regulation (*awig-awig*), and (iii) irrigation system managed with the concept of proportional, where it also includes a system of mutual lending irrigation water et cetera. Thus, farmers as the subak member feel their interests to have been served and result in an atmosphere of harmony and togetherness within the subak irrigation system. This has been going on since the system was established, and remains to be conducted until now. It is this condition causing the subak system in Bali to exist up to present time.

## Preliminary

Existence of subak irrigation system in Bali has been known since 1071 AD, or approximately 1,000 years ago. Until now, subak system in Bali remains to exist, and even has the capability of playing a role in national development processes. According to Suyatna (1982), the subak system plays an important role in supporting the national development particularly in the agricultural sector. Although subak is a traditional organization, it is different from other traditional organizations, which in general often impedes the national development programs.

In keeping with the rate of population growth, and the large amount of land demand for the sake of various development activities, particularly for the tourism sector, so the rice field acreage within a particular subak area tends to diminish. Even, there are subaks located in the suburban areas only leaving some three or five hectares of land. However, the subak stays to exist in playing the role pursuant to its functions. Among them, at least (i) it distributes the irrigation water equitably to its members, and (ii) conducts a religious ceremony in the territory.

Basically, a subak system is defined as the association of farmers managing the irrigation water at a particular wetland area and getting irrigation water from a particular source, at least manages one temple, and has autonomous characteristic both internally and externally. So, as long as farmers manage the irrigation water collectively in a certain territory

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(though it is a small area), have a temple and a source of irrigation water, and are autonomous in nature, they still may be cited as subak organization.

Since the subak has to manage a temple, so the subak is then often referred to be socio-agrarian-religious. Some researchers call it a socio-technical-religious organization. It is called to have 'technical' characteristics and not 'agrarian' in nature because subak does not only manage the technical aspects of the irrigation, but also the technical aspects of agriculture. Furthermore, the existence of temple is considered to be one of the binder (aside from having an interest in irrigation water), causing the subak to have a strong unity and togetherness.

The roles of subak comprises (i) to manage irrigation water, so that it can be distributed equitably to the farmers as the members, (ii) to carry out the maintenance of irrigation system, (iii) to carry out the mobilization of resources (contributions of money, execution of mutual assistance), (iv) to handle conflicts that may occur, and (v) to carry out ritual activities. Ritual activity is the implementation of a very unique role in the subak irrigation system, and at the same time becomes the supporting power of subak. Therefore, in the process of formation of coordination agency among the subak irrigation system, and then they should be able to agree with a single temple that they should manage and worship together.

It is worth noting that coordination agency among the subak systems can be established in the subaks obtaining irrigation water from the same source (weir/dam, or water divider). Such coordination agency is called *Subak Gede*. In addition, it can also be set up a coordination agency among the subak systems taking advantage of one or more rivers. Such coordination agency is called *Subak Agung*.

Meanwhile, Susanto, et al (1999) also notes several characteristics of the subak system, where such characteristics may be very important role in strengthening the subak organization for the sake of sustainability. Notes of characteristic are as follows.

- (1) Subak is farmers' institution having a complete independence from the village administration. The members are directly involved in the institution because of they have the mutual interest (direct involvement).
- (2) Subak is farmers' institution having complete rules and regulations where the members are subject to comply.
- (3) Subak has capabilities to mobilize and manage the available local resources (autonomous institution).
- (4) All of subak activities are related to socio-cultural life of the Balinese society.
- (5) Subak is one of the institutions born and rooted in the village society and structures, but it has an access to higher governmental administration.
- (6) Subak uses local resources and technology in diverting, conveying, and distributing water. Therefore, the technology is considered as an adaptive technology to local (physical and socio-cultural) environment.

Characteristics mentioned above suggest that the subak is strongly attached to the socio-cultural and autonomous community, but it has strong access to the government. On that account, subak can become an agent of development undertaken by government, and has a strong enough position in placing itself as stakeholder of the government.

Since the subak is very much admired as a typical irrigation system, many researchers are interested to conduct research and studies. Susanto, et al (1999) notes that several researchers are interested in researching the existence of subak in Bali, such as Graders (1960), Geertz (1967, 1980), Ienaga (1969), Park and Fukuoda (1976), Van Setten van der Meer (1978), Bundschu (1985, 1987), Sutawan, et al (1986, 1989, 1991), Susila (1991), and Shimmi, et al (1992). However, in general the research was conducted by these researchers had relation to the technical aspects of the subak traditional organization and regarding to the relationship of subak system with the physical condition of the water resources. Furthermore Windia (2006) examines the possibility of subak system that can be transformed into other regions having different cultural backgrounds from that of Bali. Some studies specifically tried to explore the various possibilities causing the subak system could continue, apparently have not been widely applied. Therefore, this study will attempt to trace it.

### **Subak through the times**

Subak in Bali has existed since the tenth century, and until now still exists and provides services to its members (farmers). This indicates that the subak system (along with all problems and drawbacks) can sustainably serve to portray itself as an irrigation system having socio-cultural characteristics. But, on its current passage, subak encounters many challenges, and goes through the process of marginalization. This matter seems commensurate with the increasingly marginalization of agricultural sector.

Noriken, et al (2007) notes the development of subak over the time. In Bali, circa 600 AD had been known about the culture of dry land farming (*parlak*) and wetlands/rice field (*huma*). Meanwhile, subak has existed in 1072 AD (Goris, 1954). On that account, wetland farming system (rice field) has existed before the eleventh century (Purwita, 1986). Definition of subak according to various sources, among others, Leafrink (1889) states that subak is the agency regulating the water into rice fields for agriculture. Furthermore, Graders (1984) mentions that subak in addition to a good irrigation system, is also very effective for the land tax collection (*land rente*). Meanwhile, Raka (1955) says that subak is the association of rice fields receiving water from one river flow, or one branch/tributary.

Apparently, all definitions given refer to the same sense that subak is a traditional institution handling water management at an independent and permanent farming level based on cultural nuances of Balinese Hinduism (*Tri Hita Karana*). During its development, as long as Bali under the administration of Majapahit Kingdom in 1343 was appointed *sedahan* officers functioning to coordinate several subaks within one of water resource territory. For wetlands, it was called *Sedahan Yeh* (*Sedahan Tembuku* or *Sedahan Tukad*). Meanwhile, *Sedahan* for dry land was *Sedahan Tegal Abian*. At the regional level (of the kingdom), it was coordinated by the *Sedahan Agung* that also served as treasurer in charge of the kingdom other than fostering the *sedahan*.

Since the influence of Majapahit Kingdom, the subaks initially attempted to obtain an independent water source, and then tried to pursue a larger water source collectively and continuously. Furthermore, they also built a dam together. With a larger water source, the subak could expand the rice field area and add their membership. Thus, it then evolved the classification of rice field land into *tempek* or *munduk*. Furthermore, the completeness of the subak management originally consisted only of *Kelian Subak* equipped with *Penyarikan*, *Petengen*, *Kesinoman*, *Saya* and other organizational instruments. Other than having positive

element, it also had negative elements in the time of the kingdom. Among them, there was a seizure of water resources until triggering wars, namely between the Badung Kingdom and Mengwi Kingdom.

During the administration of the Dutch East Indies Government (1908), in the prosperity program launched around in 1914, it was made a plan to increase the subak irrigation. The program was commenced by performing a study about the existence of subak in South Bali. Then, it was resumed with the construction of a permanent weir (dam) on a number of irrigation areas such as: Dam at Pejeng, Gianyar (ca. 1920), Dam of Peraupan (ca. 1923), Dam of Ongan (ca. 1925), Dam of Mambal (ca. 1928), and Dam of Kedewatan (ca. 1930). All dams were located in the Ayung River irrigating the existing subaks in the frontier of Badung and Gianyar region. The rapid development at the time was inseparable from the activeness of the *Sedahan Agung* helping the South Bali Irrigation Office (Agung, 1954).

At the time of Dutch East Indies Government (1908-1942), other than performed by *Sedahan Agung* the coaching of subak was and also assisted by the Office of the South of Bali Irrigation Services for irrigation control and the Office of Agricultural Services for the business and agricultural technology. An amazing thing happened in the days of the Badung and Mengwi Kingdom where at the Peraupan Dam on the Ayung River had existed the coordination agency between the subaks, namely the *Subak Gede Praupan*. However, the name and existence of *Subak Gede Peraupan* has not been heard after the Age of Independence up to 1970. After the Proclamation of the Independence in 1945, new irrigation development was carried out more intensively since 1950 shown by the handling of Sungai River-Penet River, Ho River, Telaga Waja River stream and others. Coaching of the subak institution was conducted by the *Sedahan Agung* assisted by the Department of Public Works and the Department of Agriculture. At that time, the legislation in the field of irrigation only prevailed on Java and Madura Island (*Algemene Water reglement*, 1936). In the early of the Five-Year Development Plan (Repelita) I in 1969/1970, it was published a Presidential Instruction (Inpres) No. 1/1969 concerning with the Implementation of Irrigation Management (Water Management and Irrigation System Maintenance). For Bali region, the Presidential Instruction was followed up by Decree of Governor No. 11/Perbang/61/II/C/1972 concerning with the Committee of Irrigation. From then, coaching of subak was handled by the Committee of Irrigation in terms of allocation and regulation of water for irrigation. Meanwhile, the institution playing an active role in the field consisted of three agencies namely *Sedahan Agung*, Department of Public Works (Irrigation Section) and the Department of Agriculture.

Furthermore, the existence of subak was supported by the Regional Regulation No. 02/PD/DPRD/1972 concerning with Bali Provincial Irrigation. Position of the *Sedahan Agung* was very prominent representing the Regent/Mayor to resolve all problems associated with the building water control system. At the national level followed by the publication of Law No. 11/1974 concerning with Irrigation, Government Regulation No. 22/1982 on the Procedures for Irrigation Management and No. 23/1982 concerning with Irrigation. Existence of these rules clarified the management of water resources, development of farmer organizations and the recognition of the existence of subak. As an effort to further improve the subak irrigation management, in 1976/1977 it has been tried to revive the coordination agency among the subaks by the establishment of Subak Gede at Caguh Irrigation Area, Tabanan, that represented 12 subaks coordination obtaining water from the Caguh Irrigation Dam. Establishment of Subak Gede Caguh was done simultaneously with the construction of

five weirs into a single dam. After the establishment of coordination agency of Subak Gede Caguh in 1978, *Sedahan Agung* was assisted by the Head of Branch Office of Public Works and Tabanan Agricultural Services could realize the establishment of some Subak Gede including: Subak-Gede Pama Polean (1979), Subak Gede Peneng (1979), Subak Gede Aya (1980), Subak Gede Gadungan Lambuk (1982), Subak-Gede Jadi (1983), and Subak Gede Empas (1984). Later on, it was followed by the formation of Subak Gede in the Regency of Bangli, Klungkung, Jembrana, Badung, Gianyar and Karangasem.

Furthermore, due to cooperation of Department of Public Works/Directorate General of Irrigation with Udayana University in 1991, it has been able to set up a number of Subak Gede at Ho River area in the Tabanan Regency and in the region of Banyumala River in Buleleng Regency. Afterward, it has also been formed two Subak Agung namely Subak Agung of Ho River in Tabanan and Subak Agung of Banyumala, Buleleng Regency denoting a coordination agency among the Irrigation Areas (Subak Gede) in a particular region (Sutawan, et al, 1989 and 1991). Apart from developing the subak institution and Subak Gede, since the establishment of Subak Museum in Kediri Tabanan in 1981 and its expansion into the Mandala Mathika of subak in 1988 has added the medium of subak guidance. Moreover, the existence of the Water Management Training Centre (WMTC) has become a training center for subak organized by the Directorate General of Irrigation, Department of Public Works with the working unit of Water Use Management Development (PTGA). Since 1988 the PTGA has conducted regular trainings on subak and irrigation to the management of subak irrigation, prominent farmers, officials of village level, subdistrict and regency related to the problems of irrigation and subak. Training has provided a positive influence to the improvement of skills in the water resource management.

As already mentioned earlier, it has been issued the Law No.7/2004 concerning with the Water Resources and Government Regulation No. 20/2006 concerning with Irrigation. In the Law No. 7/2004 was listed the articles that referred to the Rights on the Water Usage. This article was feared to be able to have a negative impact on the subak. For that purpose, it was necessary to think about the endeavor to maintain the sustainability of subak system in Bali.

## **Factors of Subak Sustainability**

As mentioned earlier that subak is basically an organization, namely of farmers' organization. Of course, establishment of an organization must be based on a value or a particular mindset, which will be struggled in the organization. Therefore, Kast and Rosenzweig (1979) and Sudjadi (1989), mention the organization is basically a team-oriented work on achieving goals. It is also said that the principles/foundation that must be carried out by an organization are justice and togetherness. Therefore, if an organization can meet the interests of its members fairly and in the atmosphere of togetherness, then the organization would survive.

Similarly, the subak system is basically an organization of farmers. The subak system will survive if it can meet the needs of its members fairly, and in an atmosphere of togetherness. It seems very analogous to the foundation/philosophy applied to the subak system namely *Tri Hita Karana*. *Tri* stands for three. *Hita* (happiness) and *Karana* (cause). So, *Tri Hita Karana* (THK) denotes three causes leading to happiness. The three causes are: (i) there must be harmony between man and God creating it (*Parhyangan*), (ii) there must be harmony between man and its neighbors (*Pawongan*), and (iii) there must be harmony

between humans and the natural environment (*Palemahan*). Universally, Pusposutardjo (2002) defines that THK is a principle/concept of harmony and togetherness.

As long as the subak system can apply the THK philosophy it adopts, the subak in Bali will continue. Arif (2002) defines that THK is basically a universal principle adopted by human beings of any religion. But only in Bali, there are social organizations (subak and customary village) clearly implementing the THK philosophy. Even, it has been undertaken since the subak system began to be known in the eleventh century to the present. When the system of agriculture began to be known in Bali in 600 AD, the agriculture was held by the community solely of technological nature. In this regard, the agriculture merely served as a tool to achieve the expected production for the sake of human life. But, when the subak system has become a popular system in 1071 AD, the influence of the kings of the region began to appear. They introduced the concept imposed on the village and subak area. Among others, it was introduced the concept of temple or *pura* (as implementation of *Parhyangan*). It might have been done, because “subak,” just as “village” was an organization that had a territory (*Palemahan*) and occupied by inhabitants (*Pawongan*). Therefore, the region needed to be equipped with infrastructure for religious activities, namely temple (*Parhyangan*). Koentjaraningrat (1993) says the first stage of cultural aspect is the activity of religious ceremony denoting the basis of sustainability.

Susanto, et al (1999) studies about the THK concept in the subak system as a holistic system of interrelationship mentioned as the relationship between cultural subsystem, social subsystem, and technological subsystem as shown in **Table 1**.

**Table 1** Linkage of cultural, social, and technological sub-systems as an integrated work of subak system.

Cultural subsystem	Social subsystem	Technological subsystem
1. Water is given by God and used as a common property.	1. Structurally, socio-grouping consists of: (i) informal leader finding water resources and as an initiator to develop its irrigation infrastructure; and (ii) formal leader chosen as manager of irrigation system.	1. Irrigation infrastructures are designed simply and easy to be built.
2. Independence depends on the capacity of people to do something by grouping.		2. Irrigation infrastructures need minimum human interference for the operation and maintenance.
3. Water right is correlated to their contribution in constructing the irrigation facilities.	2. Horizontally, social grouping consists of: (i) groups having the water right for irrigation; (ii) the groups working together by mutual assistance ( <i>gotong royong</i> ), to maintain the irrigation infrastructures.	3. Irrigation infrastructures are built by using local materials, such as: weir made from coconut woods or palm woods.
4. Water right belongs to the contributor and it can be transferred to the other member.		4. Considering hydraulic of water, such as diversion ditches designed in rectangular form
5. Justice does not belong to people and the implementation of justice is	3. Subak organization is created as stratified level:	

<p>manifested in the form of honesty.</p> <p>6. Everything is available and arranged by nature.</p> <p>7. Traditional regulation (<i>awig-awig</i>) of the subak is created either in the form of written and unwritten regulations. Normally, it consists of: water right, establishment of organization and obedience to policy, sense of leadership and honesty, as well as the operation and maintenance.</p>	<p>subak, Subak Gede and Subak Agung.</p> <p>4. Leader of subak is elected periodically.</p> <p>5. Leader of subak has a privilege: i.e. right of water, land, profit from water taxes and free from mutual assistance (<i>gotong royong</i>).</p> <p>6. Members of subak must be agreeable to give their land if it is needed to be used for constructing irrigation infrastructures.</p>	
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Source: Susanto, et al (1999).

Things mentioned in **Table 1** are essentially the principles of THK implementation, so they engender harmony and togetherness in the operational of subak system. All these things are various factors that can provide the support in order the subak can still continue.

Meanwhile, Sudira (1999) notes about THK implementation in the subak operational systems allowing the interest and satisfaction of farmer-members can be served well and accordingly. Implementation of the THK can be seen in **Table 2**.

**Table 2** Relation between Tri Hita Karana and traditional knowledge and technology used by subak.

No.	Philosophy of Tri Hita Karana	Variable/implementation of traditional knowledge and technology
1.	<i>Parhyangan</i>	Religious ceremonies activities.
2.	<i>Pawongan</i>	Existence of subak organization.
		Existence and implementation of subak regulations ( <i>awig-awig</i> ).
		Water distribution management among the subak members is based on proportional concept ( <i>tektek</i> concept), where subak members can feel satisfied.
		Cropping pattern and time of planting are managed by subak organization based on consensus.
		Managing the borrowing water in irrigation system among farmers within

		subak, or among subaks within Subak Gede and Subak Agung organization.
3.	<i>Palemahan</i>	Managing water resources and environment based on sustainability concept.
		Sediment control
		Design of irrigation system implemented is based on the consensus for satisfaction and the feeling of farmers or subak members.
		Agricultural activities are based on subak members consensus agreed in subak meeting, held regularly (usually to be arranged before planting season).
		Every block of irrigated land (usually consists of several sub-blocks or several spaces of irrigated land), owned by subak members, have one inlet and one outlet, or usually called to have one inlet and one outlet system. These systems give opportunity to the subak members for borrowing water from others. Besides, those systems give opportunity for subak members to diversify the planting, even on the wet season.

Source: adapted from Sudira (1999).

Basically, the various elements recorded in **Table 2** indicate that the elements are very important for farmers' satisfaction as subak members because their rights are all concerned by the organization. In addition, farmers can also be helped overcome their problems when facing shortage of irrigation water, by providing the concepts and facilities for mutual borrowing of irrigation water. This will encourage the sustainability of subak concerned because farmers are satisfied with the service concept of the organization. As a result, farmers of subak members can be satisfied spiritually, socially and physically.

## Conclusion

An organization established must aim to meet the interests of its members, or satisfy the need of its members. This must be carried out in accordance with the values adopted by the organization concerned. Subak is basically a peasant organization managing the irrigation water, so it can be taken advantage by its members. The value developed in the subak system is the *Tri Hita Karana (THK)*, denoting the philosophy of Balinese community where the majority of them are Hindu. If an organization can satisfy the interests of its members, such organization will sustain as it will be certainly supported by its members.



Since its existence was known in 1071 AD (eleventh century), the subak system has adopted/implemented the foundation of the organization namely *Tri Hita Karana (THK)*. Thus, the subak system can continue to exist and survive up to these days. This becomes the strength of subak so that can continue persistently. As an organization based on THK, subak has implemented the elements of *Parhyangan, Pawongan, and Palemahan* simultaneously.

On that account, it can be mentioned that sustainability of subak is on account of its ability to implement the THK elements of daily activities of its members, so that it is beneficial to subak members. Meanwhile, subak can also continue because the subak system is closely related to local culture/wisdom, and has strong access to the strategic environment, especially to government. Therefore, as a traditional institution subak obtains the support from the surrounding communities. In the meantime, subak is not in conflict with the development programs implemented by government, and even is capable of providing a support.

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