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学位論文全文に代わる要約
Extended Summary in Lieu of Dissertation

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学位論文題目：
Title of Dissertation

Bridging traditional knowledge for sustainable irrigation management in West Sumatra Indonesia
(インドネシア西スマトラ州における持続的な灌漑管理のための伝統知の役割)

学位論文要約：
Dissertation Summary

Traditional knowledge, which has been developed from a long experience of human activities with ecosystem and environment, is a fundamental solution for the sustainability of natural resources. Due to the advance of the global economy and changes in social structure, indigenous knowledge has mostly disappeared. A modern approach towards managing natural resources, such as Water Users' Association ("P3A" in Indonesia) has been introduced under government totalitarianism. Yet, institutional problems such as low participation in maintaining irrigation facilities have occurred in some regions where traditional values have been excluded from irrigation management. Nevertheless, in some regions where traditional values have survived, the farmers could have managed irrigation systems under the changing policy for irrigation management. This study aims to: (1) reassess traditional knowledge in irrigation management; (2) compare irrigation management in three irrigation institutions; (3) evaluate the persistence of the traditional value in the current irrigation system and; (4) evaluate the challenges to integrate traditional knowledge into current irrigation institution, in West Sumatra.

The Minangkabau community in West Sumatra managed the natural resources collectively under customary law, such as in irrigation water management. The community has been practiced collective environmental wisdom and ethics based on cultural practices, known as *adat* (custom). The relationship between Minangkabau people and their natural environment can be illustrated by the traditional proverb *Alam Takambang Jadikan Guru* (nature is a teacher). This Minangkabau value has been implemented from generation to generation in maintaining harmony between the community and nature. Based on this value, the indigenous community had

traditionally created a spatial arrangement to utilize and protect nature such as *parak* (agroforestry) and *rimbo larangan* (prohibited forest) practices (Fig. 1).

Natural resources, such as forest, stream, and agricultural land, are managed under customary law. The Minangkabau community recognized the spatial pattern of agricultural and forestry land as a part of their village (*nagari*). In addition, forest management and agricultural management are important spatial entities of Minangkabau communities that cannot be separated from one to another. The forest management of the Minangkabau community has a distinctive way and is related to other agricultural cultivation activities, especially rice fields. For instance, forest management such as *rimbo larangan* or prohibited forest has been managed to conserve water availability for irrigation water.

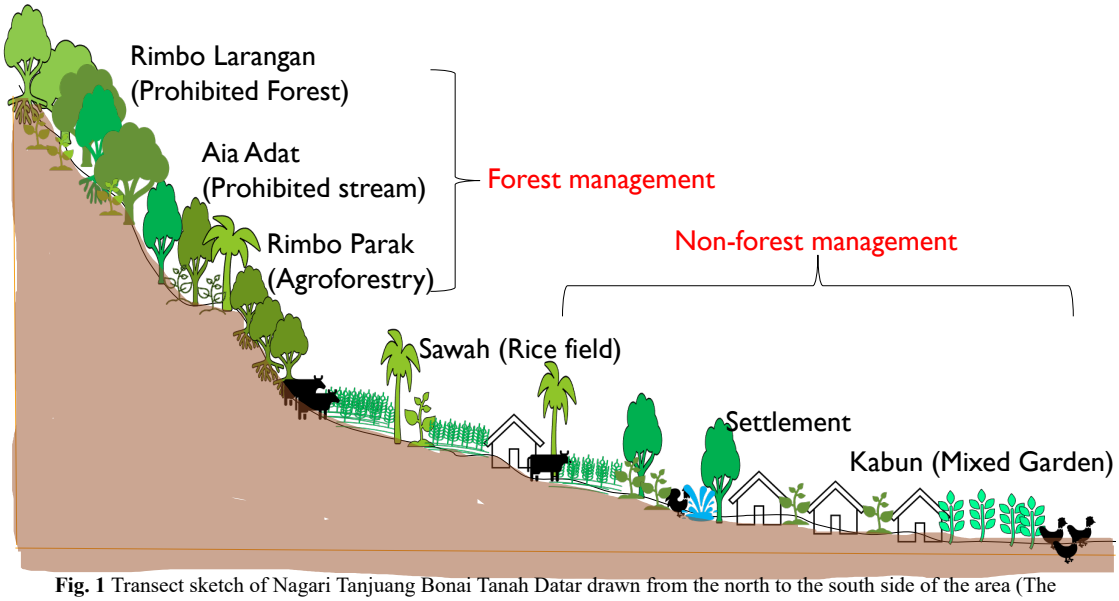

Fig. 1 Transect sketch of Nagari Tanjuang Bonai Tanah Datar drawn from the north to the south side of the area (The length, depth, height, and the number of objects (tree, cow, and house) do not represent the actual size and quantity)

The traditional irrigation system in Agam District had three characteristics as shown in **Fig. 2** . The first characteristic was that indigenous leaders had an important role in managing the irrigation system. For example, permission of *Penghulu* (clan leader) was required for constructing canals whether privately or by a group. *Penghulu* selected *Tuo Banda* (water master) to manage daily operation of the irrigation system. *Tuo Banda* has knowledge and skills in irrigation management. In the traditional system, *Tuo Banda* was not paid a salary by farmers. The second characteristic of the traditional irrigation system was *Mufakat* (consensus) that was a basic principle of decision making in traditional irrigation management. *Mufakat* was implemented in Alek Banda (harvest ceremony) that is the third characteristic (**Fig. 2**). Traditionally, there were three functions of *Alek Banda*. First, the occasion was

used to forgive past grievances from all farmers in the last planting season. Second, the next planting season was determined under *Mufakat*. Third, this ceremony was to mobilize labour for the task of cleaning canals.

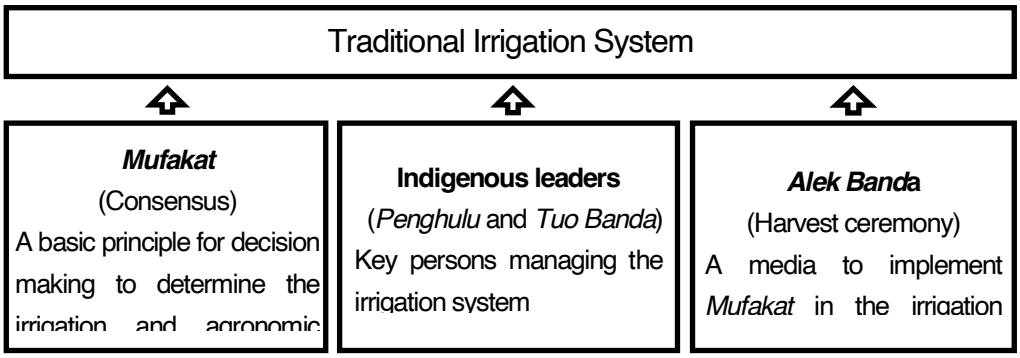

Fig. 2 Characteristics of the indigenous irrigation system in Agam District

Indigenous leadership is important in maintaining the social relationship within members of the clan. In the case of the traditional irrigation system, the roles of the indigenous leaders were for maintaining social relationships between farmers, strengthening social capital and mobilizing labour for irrigation maintenance. In order to accomplish their role in managing the irrigation system, indigenous leaders needed characteristics such as righteous character, intelligence, knowledge, and good communication skills. Having these characteristics, the leaders were subsequently followed by the community.

Based on the research results, the governmental-created institution as in P3A Jorong Biaro faced institutional problems such as low participation in irrigation management. On the other hand, the community-created institution as in P3A Karya Mandiri, where traditional values are still conserved and practiced, institutional problems have been successfully minimized. In P3A Jorong Biaro, the first institutional problem is that this P3A has been experiencing dysfunction in managing the irrigation system. The reason for the dysfunction is that farmers don't recognize the P3A as a part of their community rather as a government institution. The second institutional problem is low participation in gotong royong (communal work) for the maintenance of irrigation facilities. On the other hand, theP3A Karya Mandiri has successfully managed the irrigation system based on traditional values. This study found that *Mufakat* and the role of the indigenous leader functions as a "bridging value" between traditional and modern irrigation systems. Additionally, the location of P3A Karya Mandiri, far from city and modernization, supported the bridging value. This study found that the problems in P3A

Jorong Biaro occurred because this P3A was initiated by the local government without *Mufakat* by all farmers. This study also found that the P3A Karya Mandiri was initiated by the local community through *Mufakat*. In this case, local community members can express their interest and participate in the P3A decision making process.

Another irrigation system in West Sumatra is *Paraku* irrigation system in P3A Jorong Situgar. This irrigation system is a traditional irrigation institution based on Minangkabau values that have been existing for hundred years ago. The indigenous community designed the *Paraku* system to overcome water scarcity by using *Takuak* (water division tools) as shown in **Fig. 3**. The practices of *Paraku* irrigation system are still used by the farmers as it can distribute water fairly to each rice field. In addition, the traditional harvest ceremony, known as *Alek Banda*, has been implemented by the community to preserve *adat* and to strengthen the social capital of farmers. This study concluded that the *Paraku* management is local ecological knowledge based on traditional custom. The practices are based on conservation minds in traditional ecological practices that the irrigation practice, known as *Paraku*, seems to limit the disturbance of natural resources, which might have contributed to conserving them. In addition, the study found that the practices of *adat* have been decreasing in these recent years in response to various pressures, such as economic growth, population growth, the introduction of market values, change in occupation. The decline of Adat practice results in changes in the Minangkabau institution, particularly the role of indigenous leaders in *Paraku* management. Yet, the practice of the *Paraku* management has been preserved until today.

Fig. 3 *Takuak* (water division tools)

By compering three irrigation systems, as described above, this research found fundamental traditional knowledge that can be integrated into the current irrigation system: *Mufakat* principle, *Alek Banda*, and the functions of *Tuo Banda* as a knowledge translator. In addition, some traditional practices in irrigation management are found in the research area, which are: regulating *Aia Adat* (customary stream) for protecting irrigation water; *Alek Banda* (the harvest ceremony); regulating the construction of the weir; regulating planting schedule, during the dry season; gotong royong (communal work) activity to maintain the irrigation facilities under *Tuo Banda* and *Penghulu* concern.

Nevertheless, there are some challenges of integrating traditional knowledge, which are: the decreasing practice of *adat* in recent years; changes in the farmers' minds and values regarding the farming preferences; "knowledge gap" between stakeholders in irrigation management; and non-inclusively of traditional knowledge of water management in government regulations. Despite those challenges, the study revealed that traditional knowledge could be expected to overcome irrigation institutional problems. In addition, it could function well in managing irrigation systems. Against those challenges, this study suggests that the government should recognize traditional knowledge as a fundamental principle in managing the irrigation system. In addition, the *Mufakat* principle should be implemented in the P3A decision-making process to encourage farmers' participation in irrigation management. Lastly, collaborative action with diverse stakeholders is needed to overcome the knowledge gap between government and farmers regarding irrigation management.

Understanding local beliefs and practices are essential to incorporate traditional knowledge and practice into sustainable use and conservation policy. In conclusion, conserving and practicing indigenous knowledge based on traditional values is a fundamental solution for the adaptation of the modern system to local needs. Thus, identifying traditional values and integrating them into the modern system as "bridging values" is a key in commons governance and management of irrigation systems in Indonesia.

(注)　要約の文量は，学位論文の文量の約１０分の１として下さい。図表や写真を含めても構いません。
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