Proceedings of
The 3rd Annual International Conference Syiah Kuala University (AIC Unsyiah) 2013
In conjunction with
The 2nd International Conference on Multidisciplinary Research (ICMR) 2013
October 2-4, 2013, Banda Aceh, Indonesia

Reading the pleiades star to forecast the rain: etno-astronomy of smallholder farmers in Kisar Island-Southwest Maluku

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Abstract. This paper describes about indigenous knowledge and practice of smallholder farmers in Kisar island relate to rain forecasting through observing the Pleiades stars or the seven sisters stars. We reflected from a project on incorporating farmers' indigenous knowledge into sustainable agriculture development in small islands context and four times visits in Kisar island (1999-2011). Critical question raised is to what extent the knowledge is valid and relevance. The notion of the study was a phenomenological study. A phenomenological analysis is purely description of an immediate lived experience and an expression of its meaning (Berger and Luckman, 1976; van Manen, 1990). Rationality in phenomenology is justified by an understanding of the essence of such experience rather than just causal explanation. It recognizes the important of the context and the individual construction of perception and meaning in that context. Snowball technique was applied to find the respondents or indigenous knowledge holders. Data analysis was conducted descriptively using Ethnograph v.6. The results showed that the farmers forecast the rainfall by observing the onzet and the appearance of the Pleiades stars or the seven sisters and gauging the size and the brightness of the seventh sister of the Pleiades to predict the characteristics of the rainfall. Brighter shine and bigger appearance means more rain will come; diming and small means less rain.

Keywords: Indigenous knowledge, ethno-astronomy, Kisar island

Introduction

Living in a small island in some circumstances is quite unique and different from living in a mainland. The invaluable of smallness for sustainable livelihood of the islanders have been considered as a potential limitation for development due to limited local resources available. For example, insularity and remoteness of a small island have been claimed cause potential serious economic difficulties in terms of transportation, communication and access to the markets. However, the proponents of sustainable small islands development argued that the blessing of a small island is on the unique of its natural resources including plants and animals endemism and on its small and more cohesive community which enable them to adapt better to any changes happened in the island (Baldacchino, 2006). If a small size is a disadvantage, then this small island must suffer with a vengeance. Then, the next question raised here is that "how the islanders in a small island could survive in such limited environment until now?". Throughout this paper we try to address such question through examining the ways the islanders in Kisar island could survive under limited situation by making the best used of their indigenous bioclimatological knowledge and practices in farming to maintain their food security in seasonal changes.

Kisar island is a dry and rocky small island in Maluku province-Indonesia located just above the tip of Timor Leste. Most of its inhabitants are resource-poor farmers, planting corn, vegetable and tangerine fruit, raising livestock and tapping sugar palm Borassus sundaicus for making toddy. They have been practicing integrative organic farming system for centuries. The remoteness of Kisar island and fragility of the soil have resulted in the Kisaresse being relatively marginalized by the Maluku government. Farmers in Kisar island have been relying more on their indigenous knowledge in particular ethno rain forcasting for farming and sustaining their livelihood in the island. The role of indigenous knowledge has been widely researched in rural development (Soh and Omar, 2011).

Materials and Methods

The nature of the research is a phenomenology study which is classified as an constructive/interpretive practice of qualitative research; the focus of constructivist/interpretivist as being "*both in how people methodically construct their experience and their worlds and in the configurations of meaning and institutional life that inform and shape their reality-constituting reality*" (Gubrium and Holstein, 2000, p.488). In this sense, phenomenology was used as the framework that support "systematic attempts to uncover and describe the internal meaning structures of lived experience" (van Manen, 1990, p.10). Phenomenological analysis is purely description of an immediate lived experience and an expression of its meaning (Berger and Luckman, 1976; van Manen, 1990). Rationality in phenomenology is justified by an understanding of the essence of such experience rather than just causal explanation. Phenomenology guides us to focus concern not only about how do the farmers learn particular practices but also about the nature of the experiences of learning. Also, it recognizes the important of the context and the individual construction of perception and meaning in that context.

Data collection

Indigenous knowledge of a farmer is live experience and practices which colored with spiritual views or cosmovision of its holder (van Eijk, 1998). In certain community in many circumstances has been enveloped by sacred and secrecy and only belongs to certain family or clan, thus in the field the researchers relied more on snowball technique to find indigenous knowledge holders in the community (Grenier, 1998; van Eijk, 1998) which also means that respondents were selected using accidental sampling. Interviews were conducted using semi-structured questionnaire and recorded using a tape recorder.

Data analysis

Data were entered, coded and analyzed descriptively using Ethnograph v.6.0 (Qualis Research, 2008). Library study also used in particularly to make comparison about the same pratice in different community in the world and to find out the validity or whether the knowledge is scientifically proved.

Results and Discussion

Livelihood strategies in Kisar Island

The concept of livelihood has gained wide acceptance as a valuable means to analyze the influencing factors of human living and well-beings, particularly those of the poor in the developing world (Xu et al., 2012). Originally a livelihood is defined as comprises the capabilities, assets (including both material and social resources) and activities required

for a means of living. A livelihood is sustainable when it can cope with and recover from stresses and shocks and maintain its capabilities and assets both now and in the future, while not undermining the natural resource base. Such concept of livelihood is applied in this paper in our attempts to understand social construction of bioclimatological knowledge.

The small island of Kisar is located in the most south-western part of the Province of Maluku, Indonesia just 15 miles north of the eastern tip of Timor Leste. The size of the small island is approximately 117,59 km^2 (Maluku Barat Daya Regency in Figure, 2011). Upon arriving at Kisar via a sea going vessel, the island looks like a fort. The outer perimeter is a coral rock cliff with a hill separating the inner island (where everyone lives) and this outer cliff. Moving around the island, the occasional corridor cuts through the outer hill to the interior. The only town, Wonreli, is centrally located and facilitates government officials. The island is consist of 7 villages and 12 sub-village (dusun).

The islanders of Kisar have been applied livelihood diversification, i.e. diverse portfolio of activities, and developed 'mastery complexes', i.e. multiple capabilities in terms of knowledge and skills for social, economic and cultural survival for centuries to overcome stresses and shocks and to reduce their livelihood vulnerability in the small island. In the "mastery complexes" system a young Kisaresse have to learn multiple skills necessary for survival in the island, so by the time the reach adulthood, they have mastered most of the skills. Thus, this kind of "mastery complexes" could be considered as an adaptation mechanism of the people in the island. Here, livelihood strategies of farmers in Kisar island are the choices and activities that people make and undertake in pursuit of income, security, well-being, and other productive and reproductive goals in order to sustain their living in the small island.

The Kisaresse depend mainly on activities that utilize their natural resources to generate income for their living. Approximately 80 percent of 24,571 people of Kisar were farmers, even though it is hard to make a distinction between farmers and fishermen because people have a diversity of work including crop cultivation, livestock husbandry and fishing. Corn is the main agricultural crop, and is the staple diet supplemented by beans, green vegetables and root vegetable (cassava) for Kisaresse. Data from the District Statistical Bureau (2011) shows that the total area used for cultivation for food crops was approximately 3,510 ha, and it accounted for 30 % of the total area of Kisar, while the area for cash crops was approximately 720 ha or 6 % of the total area. Corn is traditionally planted in the homestead twice a year, just before the westerly and easterly monsoons. Other crops such as coconut and oranges are also planted for cash.

Furthermore, livestock husbandry also plays an important role in the livelihood of the Kisaresse. Besides being a source of income, livestock provide manure for maintaining soil fertility. Livestock also have a ritual meaning in the culture of the Kisaresse as a `bride price' and for the exchange of goods. Domestic pigs are also kept in the village, whereas goats are kept in fields outside the village. Goats dominate the population of livestock on Kisar Island. Data from the District Office (2011) showed that the population of goats tends to increase annually. In 2011, the population of goats attained 26,750 head and it accounted for around 52 % of the total livestock in Kisar. Besides goats and sheep, pigs, buffaloes and chickens are also raised by farmers, accounting for the remaining 48 % of livestock. The increase in livestock population has to be balanced by the availability of forage. Data from the District Office (2011) shows that natural pasture available for communal grazing in Kisar covered 27 % of the total area (3,206 ha). During the rainy season green forage is abundantly available to feed the livestock. However, in the dry season livestock suffered from a shortage of forage. Dry season in Kisar island takes place for approximately 9 months, whereas rainy season is less than 2 months.

Fishery is another activity of farmers in Kisar especially for villagers who live near the coastal area. The sea always yields a great deal, although the catch is also dependent on the season. During the easterly monsoon, for example, a village on the east side of the island cannot harvest much from its fishing grounds. During the hot season, the fish harvest is a celebration. The wind has died away and sometimes the reef is almost completely dry. The men set their bamboo fish traps out in deeper water and fish from their canoes.

Another important source of income is from arak selling. Arak is an alcoholic drink produced by fermenting the sugar sap from palm trees. During the crop planting season that goes from December until May, farmers will focus themselves on cultivation; whereas in the dry season, from August to November, they tap sugar palm *(Borassus sundaicus)* or locally named 'koli'. The abundant availability of koli trees in Kisar island could be an interesting resource to connect with efforts for sustainable livelihood development and have been an important role in the economy of poor people in Kisar island, in terms of job opportunities and income provision. Farmers tap sap from sugar palm trees *(Borassus sundaicus),* and ferment it to produce brown sugar and arak. Arak production, however is a more favoured activity than brown sugar because it yields a quick source of cash, particularly compared to any other sources they have. The practice has been done for centuries in the Kisar community and has been considered to be a part of the culture and economy of the Kisar community.

Defining 'indigenous knowledge' in the context

As context in a phenomenology study of indigenous knowledge is important, thus a key issue for the researchers then was to question what was meant by the term `indigenous knowledge' in researching farmer's knowledge. Heim (1990) pointed out that making sense of concepts to be used by a research team was an important phase of a research project. Instead of being confused by variety of definitions presented in the literatures, it was decided to accept a definition provided by van Veldhuizen et al. (1997), who states that indigenous knowledge is "the ideas, experiences, practices and information that either have been generated locally or are generated elsewhere but have been *transformed* by local people and incorporated into their way of life".

Thus, the source of insights for indigenous practices may be produced locally or gained through interaction with others. In this sense, what make such knowledge `indigenous' is the reality that it bounds local culture and emerges as people's perceptions and experiences in a certain space and time. This led to the need to understand knowledge creation as a result of a social encounter between knowing and active subjects. Such knowledge produced during farmers' everyday life, in fact, has pragmatic characteristics, which means to solve everyday problems by using available resources (Heller, 1994).

Pleiades observation and social construction of climatological knowledge

The farmers in Kisar island have a remarkable knowledge of rainfall forecasting, especially to determine the proper time *(kutika)* to sow the corn seed. The farmers' method of ranfall prediction was different from government meteorology council. The former tend to be a macro climatic prediction, which covered large areas; whereas the latter were more area specific or micro prediction.

However, only few farmers in Kisar island observed the appearance of Taurus constelations (locally called wunwe), shine not far above the horizon, to forecast the season. Wuhne in Kisaresse astronomy divided into three stars clusters :(1) wuhne laini, that is the first appear star when the sun set ; 2) wuhne ihna, The Seven Stars clusters ; (3) wuhne iurhne, kite-like stars with a tail. They also recognized a transition

season (pancaroba) dominated by strong wind, which metaphorically because of the crippling of the wunwe iurhne. During a transition, strong wind rain may also occur.

The Seven Sisters observation, from the researchers' point of view, is the most interesting practice to explore. One indigenous knowledge holder commented that: "most of the farmers in the village plowing and planting corn as on time when the rain fall to their land, but my family usually do planting a week before the rain fall, so the corn will grow with enough water in the soil. I start to plow land as I have already saw the onset of the Pleiades in the night sky...when the Pleiades have already appeared [with naked eyes], then daily I will observe the apparent location, distance, size and brightness of the Pleiades to forecast the timing and quantity of rain…during November and December when the dawn and the Pleiades appeared in the east signaling that the rainy season is coming soon; during July and August, the appearance of the Pleiades in west indicating that dry season will start soon…if the Pleiades appeared big and bright indicated that the rainfall will *good* whereas if it appeared small and dim then I will plow my land only small size because the rain will drop *less*…this month (*November*) I saw the apparent of the Pleiades…"let us make a bet.... I forecast that the slight rain will come on the day of 15, it would be enough for us for planting.... on that day I will serve you with food... I will slaughter a pig for celebrating".

Then the researchers ask him "what make him so sure the rain will falling on the day of 15 November?". Then he explained: "I look at the brightest star among the Seven Sisters cluster... if she is dimming and small [size] means she is shy appearing herself... so less rain will come. In the contrary, if the bright is full and bigger means heavy rain and good season".

In the farmer's point of view, the appearance of the Seven Sisters' stars (Pleiades) in the east during November and December is an indication of the beginning of rainy season. Reversibly, the appearance of the Pleiades in the west during July and August indicated that the dry season will come soon. The farmer gauge the stars brightness, note the stars' apparent sizes and the positions of the brightest stars for making forecast about the quantity of rainfall, heavy or slight. Their method of forecasting was elegant, surprisingly accurate and for them intuitive. It was really a matter of big, bright Pleiades equals big rain, equals big corn harvest versus small, dim Pleiades equals small rain equals small corn harvest.

The farmer indigenous knowledge of Pleiades appearance is not static but dynamic. New meaning of the appearance of Pleiades to his farming practices continually emerges during his interaction with the environment. Trial and error experimentations and carefully observations were the primary ways of the farmer to learn of Pleiades appearance and possibilities of rainfall. The farmer conducts such experiment in attempts to fulfill his curiosity the pattern of the stars onset. Through the processes of making sense or understanding, the experiences then were transformed into knowledge which enriches farmers' stock of knowledge. The transformation from experience to knowledge passes through stages of increasing articulateness experience is initially stored in the form of image, mental representations which can serve as model for future action without being articulated. Here, the farmers' collective cognition that is values and beliefs acts as a screen to filter the new experiences. More specifically, it then acts as a luggage frame of reference in dealing with the same problem in the next season.

Other bioclimatological knowledge for forecasting the season in Kisar island is by observing the appearance of the rain clouds which is a common indicator for the farmers of the possibility of rainfall in an area. An old farmer explains an indigenous thumb rules of weather forecast as follow: "east season rain usually drops from the east side, so do west season rain from the west side .... We just observe that pattern. Thus, now is

east season, so we just observe the clouds from the east, if it already `white' [appeared heavily], of course the rainfall will come son" [Sarak, 64 y.o.]. The farmers also watched over lightning, colour of the sky, rumbling, thunder and few which signalling rain. They noted that low wind velocity and very high temperature as indicators of the development of embryo of the rain.

Besides climate indicators, the farmers also using biological indicator for predicting rainfall. The sprout of fig tree has also been used to predict the beginning of rainy season. A farmer explained: "there is an old fig tree in Bunga Lehen house. I usually observe the appearance of its sprouts to forecast rain. If it starts to sprout and looks healthy... the good rain season will come soon *good*" [Sarak, 64 y.o.].

Roncoli et al. (2002), who conducted inquiry in Burkina Faso, found that the farmers were used some trees as biological indicator for rainfall forecasting because of the trees require certain temperature and humidity for producing flowers and fruits. The farmers have made a long observation on this behavior before relating it to the season. The same bioclimatological knowledge and practices could be found in Javanesse community, in particular farmers at Gunung Kidul and Gunung Merapi. The practice called Pranatamangsa, the Javanesse agricultural calendar; for further reading on this matter, see Daldjoeni (1984). Professor Benjamin Orlove, a climate anthropologist from University of California, with his colleagues have proved that such indigenous knowledge and practice on using the appearance of Pleiades to forecast the rain is accurate, valid and reliable (Orlove et al, 2000; Orlove et al, 2002; Strauss and Orlove, 2003). In Orlove's publications, his research with indigenous Aymara and Quechua speaking Andes farmers in Peru and Bolivia who plant potatoes. For four centuries the farmers observe the Pleiades in the late June to forecast the weather during the growing season (October-May). Observations take place often begin around 15 June. They occur an hour or two before dawn, when Pleiades are located low over the horizon to the northeast.

The findings of Orlove and his colleagues regarding Pleiades for forecasting the rains bring the challenges for synergistic collaboration between farmers' indigenous knowledge and agricultural science for the betterment of farmers. The collaboration aimed to build a local theory that is a share framework about their own reality. DeWalt (1994, 127-128) highlighted the benefit of this potential synergistic relationship as follows: "It is important that we see indigenous knowledge systems and scientific knowledge systems as complementary sources of wisdom. Indigenous knowledge systems ... provide some useful guidelines concerning potential future directions of scientific research...scientific knowledge systems have the advantage that they can broaden the base of understanding and provide a much greater array of options to farmers. we need to try to achieve the holistic understandings that are characteristic of indigenous knowledge systems... We should aim for knowledge that falls somewhere between *the two knowledge systems".*

Conclusions

Although farmers indigenous knowledge regarding using Pleaides to predict the rainfall is socially constructed in its particularity within Kisar island context, however it is also can be found in Java and in South America, and scientifically proved as accurate and valid knowledge and practice by scientists.

Acknowledgements

The authors would like to express gratitude to Mr. Simson Isack and his big families for their willingness to share their knowledge on stars observation for predicting the season. Also to Mr. Sarak and Mr. Amos Maanary for such inspirational conversations on bioclimatological knowledge and star lores in Kisar community.

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