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Pangeran Beach Hotel
Padang, West Sumatra, Indonesia

CONFERENCE PROCEEDING

The 4th **International Conference on Asset and Facilities Management (ICASFAM)**
and
The 3rd **Sustainability Initiatives Case Study in Malaysia, Philippines and Indonesia (SIMPI)**

Conference Theme

“Sustainability of Innovation for Better Future”



Organized By

Bung Hatta University

- Civil Engineering Department
- School of Postgraduate Studies
- Faculty of Civil Engineering and Planning

Collaborators:





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Dear Colleagues and friends,

In this opportunity of the 4th International Conference on Asset and Facility Management (ICASFAM) and the 3rd Sustainability Initiatives Case Study In Malaysia, Philippines and Indonesia (SIMPI) on behalf of the Organizing Committee, I would like to welcome you all to attend this prestigious conference. The 4th International Conference on Asset and Facility Management and the 3rd Sustainability Initiatives Case Study In Malaysia, Philippines and Indonesia (SIMPI) was held on 4-6 October 2017 in Pangeran Beach Hotel, Padang, West Sumatra, Indonesia. The objective of this conference is to be a forum discussion and disseminate widely the result of researches and the new technology including useful information in the domain of asset and facility management and sustainability issues in regional and multi-national scale.

For that reason, main theme of this conference is set on the “Sustainability of Innovation For Better Future “. However, we have also put our interest on the sub-themes to cover wide spectrums topics of 4th ICASFAM : Asset and Facility and sub themes are ranging from *Risk Management, Maintenance Management, Asset and Facility Management, Project Management, Operation Management, Construction Management, Strategic Management, Technology Management, Legal Aspect for Asset and Facility Management, Asset and Facility Management Information System and Asset and Facilities Assessment.*

Beside that, topics of 3rd SIMPI : *Sustainability of Innovation with sub themes are: Educational and Cultural Sustainability, Sustainable Energy Planning and Management, Fishery Resources Management, Business and Environmental, Disaster Risk Management and Mitigation, Disaster Crisis Management, Sustainability in Building and Facilities, Sustainability Education, Environmental Sustainability and Green Building Sustainability in Economic, Cultural and Social Perspective.*

In this regard, I sincerely thank all members of the scientific committee, keynote speakers and invited speakers, who have contributed a large portion in this conference. I would like also to thank all of my colleagues in the organizing committee that have been worked so hard to prepare this conference.

Finally, I wish this conference will have a great success and all participants will obtain large benefit to broaden their knowledge particularly in the area of asset and facility management. We really hope that all participant will enjoy their stay and have a sweet memory in the beautiful city of Padang.

Yours sincerely,

Dr. Ir. Bahrul Anif, MT.

The Chairman of ICASFAM-SIMPI 2017 Organizing Commite



Conference Proceeding

The 4th International Conference on Asset and Facility Management

The 3rd Sustainability Initiatives Case Study in Malaysia, Philippines and Indonesia



Dear Participants,

The 4th International Conference on Asset and Facility Management (ICASFAM) and the 3rd Sustainability Initiatives Case Study In Malaysia, Philippines and Indonesia (SIMPI) is a agenda of the Graduate Program of Bung Hatta University and the Faculty of Civil Engineering and Planning of Bung Hatta University.

On behalf of the local organizing, it is our great pleasure to cordially welcoming you to the 3rd International Conference on Asset and Facility Management on 04-05 October 2017, in the Pangeran Beach Hotel, Padang, West Sumatra, Indonesia. The major theme of this conference is “*Sustainability of Innovation for Better Future*”. This conference is a great opportunity to discuss particularly in the area of asset and facility management and to network with colleagues.

We hope you will enjoy the conference and your stay in Padang, and leave this event enriched with ideas and friends.

Yours sincerely,

Dr. Nengah Tela, ST., M.Sc

Dean of Civil Engineering and Planning Faculty of Bung Hatta University



Conference Proceeding

The 4th International Conference on Asset and Facility Management

The 3rd Sustainability Initiatives Case Study in Malaysia, Philippines and Indonesia



Dear Participants,

The 4th International Conference on Asset and Facility Management (ICASFAM) and the 3rd Sustainability Initiatives Case Study In Malaysia, Philippines and Indonesia (SIMPI) is a biannual agenda of the Civil Engineering Graduate Program of Bung Hatta University, aiming to get information and the development of science in the field of Asset Management in Civil Engineering Graduate University of Bung Hatta.

On behalf of the local organizing, it is our great pleasure to cordially welcoming you to the 3rd International Conference on Asset and Facility Management on 4-6 October 2017, in the Pangeran Beach Hotel, Padang, West Sumatra, Indonesia. The major theme of this conference is “*Sustainability Of Innovation For Better Future*”. This conference is a great opportunity to discuss particularly in the area of asset and facility management and to network with colleagues.

We hope you will enjoy the conference and your stay in Padang, and leave this event enriched with ideas and friends.

Yours sincerely,

Dr. Zaitul, S.E, MBA., Akt.

Director of Graduate Program of Bung Hatta University



Dear Participants,

On behalf of Bung Hatta University, I respectfully welcome you all to our beloved city of Padang the capital city of West Sumatra Province. On the 4th International Conference on Asset and Facility Management (ICASFAM) and the 3rd Sustainability Initiatives Case Study In Malaysia, Philippines and Indonesia (SIMPI), we highly appreciate the participation of Professors, academicians, researchers and practitioners for accepting our invitation to discuss current and various issues related to Asset and facility management.

We also would like to appreciate the continuous support of our provincial Government, especially our governor Prof. Irwan Prayitno to the development of our university. The government of West Sumatra has been our strategic partner for more than 30 years in providing higher educational services for our community towards better quality of life.

On behalf of Bung Hatta University I would like to thank the Governor of West Sumatra for its kindness to host the welcoming dinner and the Minangkabau cultural presentation for our honorary guests of the The 4th International Conference on Asset and Facility Management (ICASFAM) and the 3rd Sustainability Initiatives Case Study In Malaysia, Philippines and Indonesia (SIMPI) on October 4th, 2017. I would also like to appreciate our partner of the conference; University Technology Malaysia (UTM) Malaysia, Far Easter University (FEU, Philippines), Griffith University (Australia), Saveetha University (India) and all of the sponsors. Last but not least, my deep appreciation to the committee, both steering and organizing committee, for their hard work for this conference. We do hope that the conference will provide fruitful outcomes for our academic exercise towards the better quality of life of our society.

Yours sincerely,

Prof. Dr. Azwar Ananda, MA.

Rector of Bung Hatta University

**The 4th International Conference on Asset and Facility Management
The 3rd Sustainability Initiatives Case Study in Malaysia,
Philippines and Indonesia**

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Ethno-mathematic Exploration at Gonjong Rumah Gadang in South Solok Regency of West Sumatra

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Abstract. This study aims at analyzing the ethno-mathematics' exploration for basic information in the development of ethno-mathematics. Type of this research is exploratory excavation that is conducted through exploratory research on the cultural phenomenon. The method of this research is through valid interviews via questionnaire and data processed via taxonomic analysis. Taxonomic analysis was done to create categories of cultural symbols that exist in the studied culture. The research was conducted in South Solok with the object of research is the shape of carvings and the number of gonjong from rumah gadang. From the data analysis, the result obtained that South Solok has various types of rumah gadang; 62.96% types of *surambi Aceh begonjong ciek*, 25.93% types of *gajah maharam*, 7.41% types of *gonjong ampek sibak baju*. For two existing sub-districts in South Solok such as Nagari Sitapui and Nagari Abai; almost all of the types are symmetrical while the others are various. Overall, there are 74.07% symmetrical shape and 25.93% are not symmetrical. The amount of gonjong in south Solok based on Mathematics' theory of even and odd numbers; there are 51.85% for odd gonjong and 48.15% for even gonjong.

Keywords: Etnomatematika, gonjong, South Solok

1. Introduction

The study results of TIMSS (*Trends in International Mathematics and Science Study*) in 2011 that put Indonesia at below average and far behind neighboring countries such as Singapore, Malaysia and Thailand is due to the lack of understanding of students in reasoning and problem solving so that students are less able to solve problems related to reasoning and problem solving. More over, based on facts in society, learning is only used as a benchmark for achieving values, but not be based on students' understanding and problem solving.

Whereas students do not realize that they have been applying mathematics in their social life. They tend to consider that mathematics is only found in computing, measuring, shopping, or cultural art in the form of carvings - both in carvings of rumah gadang or carving in woven, clothing, and jewelry. Rumah Gadang is widely spread in West Sumatra, especially in the southern Solok area called the land of 1000 rumah gadang. There are various forms of carving in rumah gadang with the form of circular and square carvings.

Mathematics as a basic science needs to examine the basics of arithmetic that can be applied to the community to enrich the development of mathematics. Hiebert and Carpenter (1992) in Tandililing (2013) stated that the mathematics teaching in school and mathematics found by children in everyday life is very different. Therefore, mathematics learning must provide a charge / bridge to mathematics in everyday life that is based on culture (Ethnomatematics).

Ascher (1991), Ethno-mathematics is a mathematics that grows and develops in a particular culture. Ethno-mathematics is perceived as a lens to view and understand mathematics as a cultural product. The culture here refers to the language of society, place, tradition, way of organizing, interpreting, the concept of aging, and giving meaning to the physical and social world.

Ethno-mathematic ideas will be able to enrich existing mathematical knowledge. Therefore, the development of ethno-mathematics has been widely studied and taught in a modest way by adjusting the local culture. Biosop (1994b) in Tandililing (2013) states that mathematics is a cultural form; and has been integrated in all aspects of people's

lives wherever located. Ethno-mathematologists argue that basically the development of mathematics cannot be separated from the culture and values that already exist in society.

Situmorang (1993), Culture not only means literally as human thought, feeling, endurance, tradition, but also has a broader meaning on how to apply all of the aspects into the life of society and provide benefits for their lives and others. Culture is a symbolic representation of the movement of space and time in the universe in which several events take place. According to Piliang (2009), a culture encompasses the social system of its society, the moral system, the material techno system, the art system, the language system and the mental system that builds the society.

Culture is something that cannot be avoided in everyday life, because culture is a unified whole that prevails in a community. Tylor in Ratna (2005) defines culture as the whole of human activity, including knowledge, belief, art, morals, law, customs, and other habits. While Koentjaraningrat (1985) according to the science of anthropology, culture is the whole system of ideas, actions, and the work of human beings in the framework of the life of society that made human self by learning.

From some opinions of the experts above, it can be concluded that almost all activity of human being is a culture because most actions of human being require learning to familiarize it. The culture as a heritage or tradition of a society develops in the Minangkabau community are including mathematical concepts on cultural relics in the form of carvings on the house gadang, traditional art songket motifs such as randai, pencak silat and so forth.

Mathematics grows and develops in different parts of the world, not just in one location or region only. It is growing in the territory of India, America, Arab, China, Europe, even Indonesia and other areas. Growth and the development of mathematics occur because of life challenges humankind in different areas with a variety of different cultural backgrounds. Rachmawati (2014), every culture and subcultures develop their own mathematical manner. So that mathematics is seen as the result of human mind in the activities of everyday society. This concludes that mathematics is a cultural product of abstraction of the human mind, as well as problem solving tools. As expressed by Sembiring in Prabowo (2010) that mathematics is the construction of human culture.

Rachmawati (2014) Understanding of values presented by teachers in the learning of mathematics is not included possible aspects yet. Mathematics is seen as a tool to solve practical problems in the world of science, thus ignoring the mathematical view of human activity. Soedjadi (2007) in Rahmawati (2014) Both views are absolutely not wrong, both true and in accordance with the growth of mathematics itself. However, the consequences or effects of mathematical teaching routines during this time is that math is merely a tool in the educational process of the nation is not appropriate; without criticizing why the tool is worn, how the tool is used, how children learn to use it, without knowing how the tool is made. In fact, not a few teachers are hooked to meet higher test scores.

Yosaadi (2011) Rumah Gadang is characteristic of Minangkabau Traditional House (West Sumatera) which functions as a residence of big family and center activity for the descendant of matrilineal relatives – economic, social and cultural activities, headed by a tungganai (Uncle), with a roof shape architecture bergonjong (buffalo-shaped horn). Andika (2014) Rumah Gadang has uniquely architecturally with a pointy roof shape that resembles buffalo horns and formerly made from fibers that can last up to tens of years, but later many roofs changed with a tin roof.

Rumah Gadang is made in rectangular and is divided into two fronts and backs. From the front of Rumah Gadang, it is usually full of ornamental carvings and generally patterned root, flower, leaf and rectangular and parallel plane. Andika (2014) Rumah Gadang is decorative filling of fields in the form of circular or square lines.

Rumah Gadang is generally used as a place to conduct activities and as a place of family gatherings. Basically rumah gadang is established to accommodate the activities undertaken by the community. Rumah Gadang is a representation of the pattern and way of life of Minangkabau society that is closely related to the values and worldviews of the

Minangkabau community it self. *Gonjong* roof of Rumah gadang by Munir, et al. (2015) Roof of Rumah Gadang curved like buffalo horns or like the arrangement of betel in the cerana which the pointed roof or tapered upwards called *gonjong*. The *gonjong* was originally made of fibers, but now has been replaced by other materials such as zinc.

According to Munir, et al. (2015), "The meaning of the upward curved shape is symbolized as two hands upward when praying". The house must contain a spiritual meaning because human beings who are inhabited inside not only require external food but also inner food in the form of prayer and dhikr.

Gonjong is part of the roof in rumah gadang. *Gonjong's* function in some advises said: *gonjong rabuang mambacuik*. *Rabuang* is a little bamboo that just come out of the ground; *mambacuik* is sticking out of the ground. The function of *gonjong* symbolizes strength and rapid growth, which means the symbol of fertility. It shows the greatness of the Minangkabau. The number of *gonjong* are not determined freely by the property owner. In determining the amount, they should pay attention to the applicable customary rules. The composition of the roof is already a provision in Minangkabau adat rules.

According to Abdullah (2015) Several types of Rumah Gadang based on *gonjong*: 1) Rumah Gadang Gajah Maharam, 2) *Gonjong Ampek Sibak Baju*, 3) Rumah Gadang Surambi Aceh Bagonjong Ciek and Duo.

2. Methods

This type of research is explorative research. This research is an ethnographic approach that empirical and theoretical approach aims to get a description in-depth analysis of culture based on field research (fieldwork) intensively. This approach focuses on discovering how people organize their culture in their minds and then use that culture in life, the culture exists in the human mind. The research method is interview through valid questionnaire

The subject of this research is the gadang home about how the shape and the number of *gonjong* rumah gadang located in South Solok (West Sumatera). Research subjects were taken about 20-25 rumah gadang which located in South Solok. The research instruments are questionnaires given to traditional leaders namely *ninik mamak* (uncles), *cadiak pandai* (intelligent), *alim ulama* (priests), *bundo kandung* (mothers) who understand about the ins and outs of carvings about rumah gadang. In this study the researchers collected data by conducting interviews, observation and documentation on the shape and number of *gonjong* rumah gadang.

Basically the data to be analyzed in this study based on the results of observation, interviews, questionnaires, and documentation relates to how the culture in minangkabau contain mathematical elements. Taxonomy analysis focuses on a particular domain that is very useful to describe the phenomenon or problem that the target of research. Taxonomic analysis is done to create categories of cultural symbols that exist in the culture studied.

3. Results and Conclusions

Based on the results of the analysis, Ethno-mathematic exploration at *Gonjong* Rumah Gadang in South Solok Regency of West Sumatra related to mathematical concepts of *Gonjong* Rumah Gadang is the roof of rumah gadang. Not only that, if observed as a traditional architecture, geometries applied to rumah gadang certainly have a very important meaning for the Minangkabau community that is as a symbol that refers to the cultural identity.

Based on the theory, *bergonjong* roof shows the greatness of the Minangkabau. The number of *gonjong* are be determined freely by the owner of the house. From the number of *gonjong*, we can classify the type of rumah gadang. Here is table of number and type of rumah gadang *bergonjong* in South Solok.

Table 1. Number of *Gonjong*, Description of Place from *Gonjong* and Types of *Gonjong*

No	Sub-district	RumahGadang	Total Gonjong	Place Description	Types of RumahGadang from Gonjong
1	Nagari Sitapui Kec.Sangir Batang hari	RG 1	5	4 Back, 1 Front	Surambi aceh bagonjong ciek
2		RG 2	7	6 Back, 1 Front	Surambi aceh bagonjong ciek
3		RG 3	4	Parallel	Gonjong ampek sibak baju
4		RG 4	4	Parallel	Gajah maharam
5		RG 5	7	6 Back, 1 Front	Surambi aceh bagonjong ciek
6	Nagari Abai Kec. Sangir Batang Hari	RG 6	7	6 Back, 1 Front	Surambi aceh bagonjong ciek
7		RG 7	6	Parallel	Gajah maharam
8		RG 8	5	4 Back, 1 Front	Surambi aceh bagonjong ciek
9	Nagari Ranah Pantai Cermin Kec. Sangir Batang hari	RG 9	8	Parallel	Gajah maharam
10		RG 10	7	6 Back, 1 Front	Surambi aceh bagonjong ciek
11		RG 11	4	4 Parallel	Gajah maharam
12		RG 12	8	7 Back, 1 Front	Surambi aceh bagonjong ciek
13		RG 13	5	4 Back, 1 Front	Surambi aceh bagonjong ciek
14	Nagari Lubuak Gadang Kec.Sangir	RG 14	6	Parallel	Gajah maharam
15		RG 15	7	6 Back, 1 Front	Surambi aceh bagonjong ciek
16		RG 16	5	4 Back, 1 Front	Surambi aceh bagonjong ciek
17		RG 17	6	5 Back, 1 Front	Surambi aceh bagonjong ciek
18	Nagari Luak Kapau Kec.Pauh duo	RG 18	7	6 Back, 1 Front	Surambi aceh bagonjong ciek
19		RG 19	5	4 Back, 1 Front	Surambi aceh bagonjong ciek
20		RG 20	4	Parallel	Gonjong ampek sibak baju
21	Nagari Koto Baru Kec.Sungai Pagu	RG 21	7	6 Back, 1 Front	Surambi aceh bagonjong ciek
22		RG 22	6	5 Back, 1 Front	Surambi aceh bagonjong ciek
23		RG 23	6	Parallel	Gajah maharam
24		RG 24	5	4 Back, 1 Front	Surambi aceh bagonjong ciek
25	Nagari Pasir Talang Kec.Sungai Pagu	RG 25	7	6 Back, 1 Front	Surambi aceh bagonjong ciek
26		RG 26	6	Parallel	Gajah maharam
27		RG 27	8	6 Back, 2 Front	Surambi aceh bagonjong duo

From the table above, it can be known that various types of rumah gadang found in South Solok. 62.96% type of *surambi aceh begonjong ciek*, 25.93% type of *gajah maharam*, 7.41% type of *gonjong ampek sibak baju*, more can be seen in the picture for the type of rumah gadang.



Figure 1.Surambi Aceh bagonjong ciek



Figure 2.Gonjongampeksibakbaju



Figure 3.Gajah Maharam

According to Datuak Labuan (Uncle), the number of gonjong rumah gadang can be grouped in several types: firstly, rumah gadang bagonjong dua (two), this is functioned as family residence. Secondly, rumah gadang bagonjong empat (four), it belongs to the people who become descendants of *ninik mamak* (uncle) entitled *Datuk panghulu*. Third, rumah gadang bagonjong limo (five), belonging to the sako title Datuak Kapalo Paruik functioning as a place to live and custom events. Fourth, rumah gadang bagonjong enam (six), belonging to Datuak Penghulu Kepala Suku, customary officers and descendants of nobility. Fifth, rumah gadang bagonjong delapan (eight), belonging to the noble descendants of the ministerial level of the king of nature.

According to Susimariani (PutiBungsu) Istano Sultan Besar Tuanku Rajo Disamba number of gonjong also based on Pillars of Faith and Pillars of Islam namely Rukun Iman and Rukun Islam. According to Datuak Sai Dano (Mamak) gonjong for immigrants are only rumah gadang bergonjong 2 and for the elite society, rumah gadang bagonjong 4 in the back and 1 in front.

Table 2. Elements of Gonjong Rumah Gadang related to Mathematical Sciences

No	Waiting	Rumah Gadang	Geometry	Theory of Numbers
1	Nagari Sitapui Kec. Sangir Batang hari	RG 1	Symmetrical	Odd numbers
2		RG 2	Symmetrical	Odd numbers
3		RG 3	Symmetrical	Even number
4		RG 4	Symmetrical	Even number
5		RG 5	Symmetrical	Odd numbers
6	Nagari Abai Kec.Sangir Batang Hari	RG 6	Symmetrical	Odd numbers
7		RG 7	Symmetrical	Even number
8		RG 8	Symmetrical	Odd numbers
9	Nagari Ranah Pantai Cermin Kec. Sangir Batang hari	RG 9	Symmetrical	Even number
10		RG 10	Not Symmetrical	Odd numbers
11		RG 11	Symmetrical	Even number
12		RG 12	Not Symmetrical	Even number
13		RG 13	Symmetrical	Odd numbers
14	Nagari Lubuak Gadang Kec.Sangir	RG 14	Symmetrical	Even number
15		RG 15	Symmetrical	Odd numbers

16		RG 16	Symmetrical	Odd numbers
17		RG 17	Not Symmetrical	Even number
18	Nagari Luak Kapau Kec. Pauh duo	RG 18	Symmetrical	Odd numbers
19		RG 19	Not Symmetrical	Odd numbers
20		RG 20	Symmetrical	Even number
21	Nagari Koto Baru Kec. Sungai Pagu	RG 21	Not Symmetrical	Odd numbers
22		RG 22	Not Symmetrical	Even number
23		RG 23	Symmetrical	Even number
24		RG 24	Symmetrical	Odd numbers
25	Nagari Pasir Talang Kec. Sungai Pagu	RG 25	Not Symmetrical	Odd numbers
26		RG 26	Symmetrical	Even number
27		RG 27	Symmetrical	Even number

Based on the table above, it can be concluded that unless the 2 existing subdistrict in South Solok such as Nagari Sitapui and Nagari Abai Sangir, Batang Hari District; almost the whole gonjong rumah gadang is symmetrical and the others are various. Overall, there are 74.07% symmetrical and 25.93% are not symmetrical.



Figure 4. Symmetrical



Figure 5.Not Symmetrical

The amount of gonjong in South Solok varies in every subdistrict and based on Mathematics' Theory of even and odd numbers, there are 51.85% for odd number and 48.15% for the even number

Based on the analysis above, it can be concluded that the results of Ethno-mathematic exploration at Gonjong Rumah Gadang in South Solok Regency of West Sumatra namely:

- South Solok Regency has various kind of rumah gadang. 62,96% type of *surambi aceh begonjong ciek*, 25,93% type of *Gajah maharam*, 7,41% type of *gonjong ampek sibak baju*.
- For 2 sub-districts in South Solok namely Sitapui and Nagari Nagari Abai, District of Sangir Batang Hari; almost all rumah gadang are symmetrical and for other are varied. Overall, there are 74.07% symmetrical shape and 25.93% are not symmetrical.
- The amount of gonjong in South Solok varies in every sub-district based on Mathematics' Theory of even and odd numbers, where 51.85% for odd and 48.15% for even.

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