

# The Role of Mathematics in Making Weaving Bong of Bajawa Community

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**Abstract.** This study aims to determine the mathematical elements contained in the weaving ikat Bajawa community. In this research will also be discussed about the meaning of weaving motif weaving ikat Bajawa society. For that researchers use qualitative methods with data collection techniques in the form of interviews, documentation, and literature study. Interviews were conducted in the form of unstructured interviews, and the resource persons were weavers and customary figures. In this study, researchers will relate mathematics with motives, tools and materials as well as the economic value of the manufacture of ikat community Bajawa. The stages in this research is the stage of data collection and data analysis phase. Data analysis phase in this research are: data reduction, data display (data exposure), conclusion and verification. The analysis is done by conducting a comprehensive collection of observations ranging from descriptions, manufacturing techniques, the meaning of decorative motifs and weaving functions in Bajawa society as well as analysis in the search for differences and weaving equations. The results showed that Bajawa community bonding elements contain mathematical elements such as measurements, straight lines, and geometry seen from the similarity of ikat weaving motifs with random and rectangular triangles. Woven tools and materials have similarities with a flat wake and wake up space. There is also an element of arithmetic in the sale of ikat woven fabrics, where the price of one weave ranges from Rp500,000 - Rp600.000 to obtain benefits in accordance with expenditures and manufacturing processes.

Keywords: weaving bunch, etnomatematics

## 1. Introduction

Perhaps so far we are more familiar with batik as the nation's representative of the beauty of Indonesia in creating cloth. Whereas there is still one more fabric of Indonesian craftsman's work that is not less beautiful and charming, namely weaving. Associated with the many areas that become weaving producers, to the diversity of motives. The existence of differences in cultural and environmental background will create the uniqueness of the weaving results in each region.

East Nusa Tenggara is one of the provinces in Indonesia that is very rich in culture, in addition to rich with local culture, East Nusa Tenggara people firmly adhere to local cultural values inherited by their ancestors, one of which is the ikat which is still maintained by the people of East Nusa Tenggara.

The weaving activity seems to be a distinctive feature of almost every ethnic community in East Nusa Tenggara, including the Bajawa community. In the Bajawa community, weaving activities are called "Mane tenu / Seda tu", which is performed exclusively by women (Mothers and

young women / girls). Although the artisans of sarongs in the area have been reduced compared to the past because the craft of sarong weaving is done as a side job. This craft needs to be maintained and preserved, because it also has a high cultural value, if managed properly. It also contains its own value for the craftsmen who make it, one of which is the economic value, because of its existence it gives added value to the economy of the craftsmen concerned.

The process of producing the weavers bypasses a long and time-consuming series of work. The woven art of Bajawa society is classified as simple and not well developed with various motifs such as horses and chicken feet. Besides having a cultural and economic value, there are mathematical elements also in woven fabric. Both in the process of manufacture or in the pattern or motif woven itself.

Based on the above illustration, the author wanted to examine the "mathematical role in making weaving ikat community Bajawa". What are the mathematical elements contained in Bajawa community ikat weaving?

## **2. Theories**

### **2.1. Weaving In Indonesia**

In the past people used clothing to cover and protect the body. Along with the development of the era, the function of changing clothes not just a cover body but can be used as a means to beautify and beautify the appearance. Clothes can also reflect the status of the socio-cultural identity of the particular group (Syaraswati et al. 1993/1994: 1).

In tracing the art form of weaving, in the past the motives used are naturalistic life motifs motifs namely human motives, animals and plants. According Galestein Daar Werd cited by P. Sareng Orinbao motives of humans are considered symbols for longevity. Humans have a survival to produce offspring (Orinbao, 1992: 42).

In addition to human motives, according to Th. Van der Hoop is also quoted by P. Sareng Orinbao there are animal motifs such as:

*2.1.1. Buffalo as a symbol of soil fertility, crescent moon symbol,*

*2.1.2. The motif of the snake symbolizes the underworld or the water symbol,*

*2.1.3. Lizard motif symbolizes the god of the night sky, the animal motif of termites and shrimp symbolizes death and life as well, knotted from the habit of the shrimp to exchange new skin.*

*2.1.4. The frog motif symbolizes rainfall.*

The horn motif symbolizes life and death, attributed to the hornbills habit, which after laying eggs does not incubate the eggs but is placed in the tree hole, and the eggs will hatch due to the hot temperature of the tree hole. After the hatch then the parent picked up his son to breathe free air.

*2.1.5. Motif rooster symbolizes the sun, because the rooster is an animal that saw the dawn.*

*2.1.6. While animal motives of Hindu influence are:*

*2.1.7. The elephant motif is the symbol of the god's vehicle.*

*2.1.8. Motif horse symbol of the soul vehicle to the afterlife.*

*2.1.9. Motif of the eagle symbol of the vehicle of Lord Vishnu.*

*2.1.10. The parrot motif symbolizes love, because the parrot is considered the bearer of romance.*

In addition to animal motives there is also a motif of the tree that is the motif of the life tree that symbolizes the Supreme Oneness, by the Dayak is considered as a symbol of the presence of God, the Javanese think so and denoted by kekayon. The Tree of Life is a taboo of tribal attachment with God as the source of life. This illustrates the close relationship between God and man. Therefore the weavers use this living tree as one of the weaving motif because it is considered to have magical value that can protect the wearer of the weaving (Orinbao, 1992: 43-44).

2.2. Weaving Bong Bajawa Community and it's Usefulness

According to Ema Genoveva one of the weavers in one of the villages until it was made of ikat, because it had no clothes, so it was made of ikat. Over time, the looms went on sale for daily needs. Commonly used motifs are horse and chicken feet motifs, horse motif commonly used during dancing or other traditional ceremonies, such as: saa saa or ceremonial ceremony of custom house making and so forth. While the chicken leg motif is only used when we are dead. The existence of weaving in the life of the community has a role and is very good value economically, socially and culturally. These values can be seen from people's behavior or habits. Woven fabrics can also be a source of pride for a person or a family. It is seen when a person or family is visited by guests and will stay overnight. The obligation of the host is to provide blankets or the result of his weaving craft as a body cover at the time of going to bed or feeling cold. This habit is a pride for the host (Arby, 1995: 22).

2.3. How to Manufacture Woven Cloth

Weaving is the work or crafting of women who passed on to their daughters from generation to generation. The process of weaving Bajawa community is generally the same as other weaving weaving process. The art of weaving in Bajawa society is classified as simple and not well developed with motives such as horses and chicken feet. The process of producing the weave passes a long and time-consuming series of work. Weaving starts from the expenditure of old cotton that after drying and separated seeds. Every woman would sit stretched out in front of her house, holding a wide loom. The long thread will be stretched, tied to the pole at the other end and tied to the ropes held in the back hips of the weaver as a backrest. A fabric is created from the array of threads that are eaten from the right to the left infiltrating the limp threads attached to the retaining pole at the end and the other end facing the weavers and tied with a rope retained on the back of the weaver's back as well as functioning as the lint thread fasteners are stretched when the weaver slips the jengkang until the woven fabric is ready to be.

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#### 2.4. Meaning of Ikat Motive for the People of Bajawa

Due to the influence of Hinduism culture, the whole weave of Bajawa gives the impression of gloom, calm, so the color is dark with horse motif and chicken legs.

##### 2.4.1. Horse Motive

Horses as representations of ancestors. In the local culture, when a person dreams of a horse, it means the uranium nusi da mai nga (ancestors come to meet) because there is something very important, to be solved. To know the meaning of mimpitersebut people Ngada will carry out the division (tiba). It is commonly associated with madhu, bhaga or sa'o ngaza that are damaged or forgotten or because they do not recognize that they are from the sa'o ngaza (rebho sa'o: forgot the house, equals denying their existence). In connection with this, the horse is seen as a symbol of sanctity (go ga'e).

Horses as a symbol of authority. Le moe jara ngai (neighing like a mighty authoritative horse). In carvings on traditional houses, horses are portrayed as "jara ngai ie horses as animals that give welfare and power to their owners" (Watu, 2008: 189). In daily life, horses are judged to have intelligence, strength and are hardworking animals. Horses are often used as horse riding, to race and also as workers.

Motive jara (horse) is found in lawo (women's clothing) and also sapu lu'e (men's custom clothing). In the Ngadha tradition, horse motifs are not only found in woven fabrics but also on sa'o ngaza carvings, especially on khaba pere / kawa pere, entrance to the core of the house (one sa'o). The horse, its Latin name *Equus caballus* or *Equus ferus caballus* in Ngadha culture is seen as a symbol of representation of ancestors and purity, authority, intelligence, strength and hard work.

##### 2.4.2. Motive wa'i manu or chicken leg motive

"Chicken leg motive is a pars pro toto for chickens ie pewarta open noon" (P. Orinbao, 1992: 55). Nowadays chicken leg motifs are only found in lawo, women's clothing. But some informants mentioned that this motif is also found in sapu lu'e, men's custom clothing. In lawo, this motive is made alternating lapse with horse motif. Although interspersed with horse motifs, this motif is still called wa'i manu. A subsection  
Some text.

### 3. Research Methods

The type of research used in this study is qualitative research. Here it is inventoried mathematical concepts (ethnomatematics) contained in the weaving of Bajawa society. The data analysis is inductive based on facts found in the field and then constructed into hypotheses or theories. In this research, several steps are adapted to the topic of the problem. These steps include:

#### 3.1 Data collection stage

At this stage it is done as much and as objectively as possible to obtain data tailored to the existing problem. This stage includes: Library studies, Interview, Documentation

#### 3.2 Phase data analysis

Data analysis phase in this research are: data reduction, data display (data exposure), conclusion and verification.

#### 3.3 Subject and object of study

Subjects in this study are people who are considered to be able to answer the problem formulation to be studied and understood about ikat, such as local village *Mosa Laki* and artisan weaving ikat. In this research, the object of research is the weaving motive of the community of Bajawa Regency, Flores, East Nusa Tenggara. The time taken in this study is October 3 - December 4, 2017.

Data collection method used is field study. Using some data collection techniques as follows:

*3.1.1. Interview*

The interviews were conducted to find out the history, tools and materials, as well as the history of weaving Bajawa community. The type of interview conducted is an unstructured interview, where the question instrument is developed independently by the researcher when collecting virgin from the resource person.

*3.1.2. Documentation*

Documentation in the form of photographs and recording interviews with research subjects.

*3.1.3. Library study*

Literature study was conducted to complete the interview data and also as a reference in data analysis.

The instruments used in this study are interview guidelines. Here is a question grid on the interview:

- a. When will this ikat weaving begin?
- b. Is there a special history about weaving of Bajawa society?
- c. What motives are commonly made?
- d. What is the reason for using the motive?
- e. What is the meaning of these motives for the community?
- f. For any event ikat wears are worn?
- g. What materials and tools are used in making ikat weaving?
- h. What is the process of making ikat weaving on msyarrakat Bajawa?
- i. What is the sale price of the finished ikat weaving?
- j. Are there any guidelines in determining the price of iket loom being sold?

The analysis is done by conducting a comprehensive collection of observations ranging from descriptions, manufacturing techniques, the meaning of decorative motifs and weaving functions in Bajawa society as well as analysis in search of differences and weaving equations.

The procedure of conducting penelitainnya as follows:

- a. In this research, Researcher choose ethnomatematic topic contained in weaving ikat society Bajawa, Flores, NTT.
- b. The formulation of the problem to be answered in this research is the mathematical elements contained in the weaving ikat Bajawa society.
- c. Research method used in this research is long distance interview. One of his supporters is his instrument of interview and documentation.
- d. Prepare the instruments to be used for conducting long-distance interviews. The researcher prepares an interview text which contains questions to be asked to the resource person.
- e. Determining appropriate resource in the research. The resource persons selected for research purposes are some weaving craftsmen in the local villages.
- f. Next, the researcher starts to interview. The questions that have been designed in the instrument are then developed when the interview takes place. Furthermore, researchers asked one to document things related to weaving Bajawa community.
- g. Conduct data analysis  
After the data collected from the source, the researcher performs data analysis by reducing the data obtained, then the data is grouped into elements related to mathematics.

- h. Formulation and discussion of research results  
From the data that has been reduced, the researchers formulate and discuss about the mathematical elements contained in the weaving ikat Bajawa community.
- i. Discussion of deficiencies (weaknesses) in the study  
In this study the authors experience the limitations of place and time. So the data obtained obtained through intermediaries, so sometimes not in accordance with the desired by the researcher.
- j. Drawing conclusions on the results of the study  
After performing all the above process, the researcher concludes the result of research according to the formulation of problem and purpose.

#### **4. Discussion**

The research was conducted in Bajawa, Ngada District, Flores, East Nusa Tenggara Province. Implementation of data collection conducted on November 26 to December 2, 2017. Data obtained during the study of interviews, photos and recording of the conversation. The result of the interview was obtained by putting the recording of the talks into writing. Photographs and recordings were used as evidence of oral interviews to informants. Data analysis used is data collection, data reduction, data display and conclusion. In the data collection, the researchers took data in the form of interviews with some weaving artisans and documentation related to ikat weaving, In data reduction, the authors select and sort the data such as interview data, and documentation results that answer the formulation of the problem, In the data display, the researcher presented the data that had been selected from data reduction which was completed with information from reference books about Bajawa community ikat weaving related to the interview result. And see the relationship of weaving ikat Bajawa society with culture and mathematics and its relation using description, picture and photograph, At the conclusion, the data that have been described and then scrutinized to be able to draw conclusions that can answer the formulation of the problem.)

Analysis The results of interviews with resource persons of literature from several journals and news show that: weaving tie on Bajawa society has been going on since ancestors passed down from generation to generation to grandchild until now. Basically weaving ikat community Bajawa same with woven ikat other area. The fundamental difference of weaving Bajawa community is always to use dark elements, and the motif used only horse motif (Jara) and motif chicken feet (wai manu). While the manufacturing process is basically the same as other areas.

Tools and materials needed in weaving include:

##### *4.1. Wegah*

Made of wood, rectangular, with edges made of branches. Its function is to press the yarn at the time of weaving.

##### *4.2. Bhira*

Made of wood, rectangular, and pointed tip. Its function is to tidy the yarn.

##### *4.3. Longa*

Made of bamboo, tubular. Its function is to plan the thread

##### *4.4. Bhoda*

Made of wood, tubular. Its function is to plan the thread during the weaving process.

At the time of weaving, the weaver must use a fabric made belt, which is attached to the loom by means of a tapered pointed end.



figure4.1  
weaver position

Based on previous explanations, researchers can categorize some of the mathematical and cultural elements contained in the woven fabric of Bajawa society, namely:

#### 4.5. *Designing pattern*

Designing pattern in this case that is characteristic of ikat motive weaving society Bajawa. Motif formed in weaving ikat Bajawa society is quite simple because the pattern is formed in the form of horse motifs, dashed lines and chicken legs that follow each other. The patterns used are 1 row of horse motifs, 1 row of dashed lines, 3 rows of chicken leg motifs, and 1 row of dashed lines. So it is concluded that the pattern used in making motifs in the community Bajawa shaped series, with the specified distance looks the same, with a cloth length of about 1 ½ meters.



figure 4.6  
woven fabric

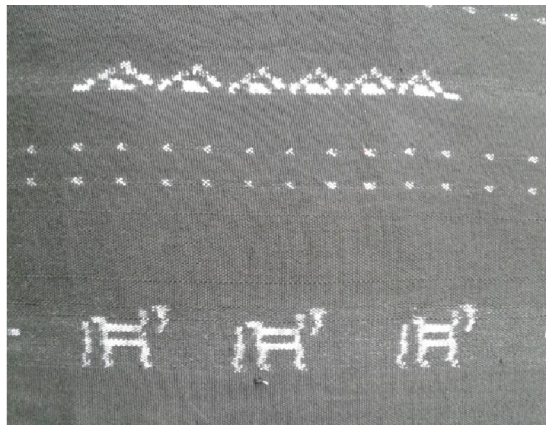


Figure 4.7  
Weaving patterns

4.5.1. Long size

In the measurement of the length of the fabric, there is no specific rule to be followed by the weaver. The length of the fabric is formed based on the desire and the ability of the weaver in making one ikat cloth. In the sense that the tool in the process of making ikat weaving has been designed so that the weavers adjust the length of the fabric to be processed. So that the woven fabric produced the same length and width. And the motifs are formed regularly according to the pattern made.

4.5.2. Concept straight

In this case, it appears that the motifs formed in this ikat loom straight. This proves that Bajawa people in the process of weaving using the concept of straight line so that the motifs formed look neat and orderly.

4.5.3. The concept of waking flat

If seen carefully, the motives formed on the weaving ikat Bajawa community has several concepts wake up flat, including:



Figure 4.8  
Chicken leg motive



Figure 4.9  
Any triangle



Figure 4.10  
Horse motive

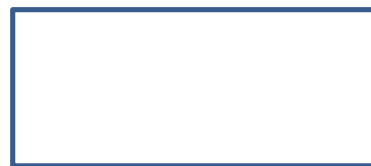


Figure 4.11  
Rectangle

4.6. Social arithmetic

In this case the selling price of one woven fabric ranges from Rp 500.000 - Rp 600. 000, where in the calculation of the price of one big reel of yarn Rp 85.000, sulfur price for black Rp 50.000 / kg, chemicals for other colors in this case the color motif Rp 100.000 / package. Total cost incurred for



manufacturing materials Rp 235,000, excluding transportation costs. So that one woven fabric sold at Rp 500,000 - Rp 600,000 to obtain profit in accordance with the expenditure and manufacturing process.

In this study the authors experience the limitations of place and time. This is because in addition to doing this research, the author was in the completion stage of the study. Therefore, in the data retrieval research, the authors conducted interviews remotely.

## 5. Conclusions And Recommendations

The conclusions that can be drawn from this research are:

1. Bond Weaving Society Bajawa is a hereditary art from generation to generation.
2. Bajawa community weaving contains elements of mathematics such as measurements, straight lines, and geometry seen from the similarity of ikat weaving motifs with random triangles and rectangles. Woven tools and materials have similarities with wake up flat and wake up. There is also an element of arithmetic in the sale of ikat woven fabrics, where the price of one weave ranges from Rp 500,000 - Rp 600,000 to obtain benefits in accordance with expenditure and manufacturing processes.

Suggestions that the authors want to convey that there is a need for more in-depth research to reveal the existence of mathematical elements in the ikat community Bajawa or other ikat tie. Tenun ikat Bajawa community can be used as a medium of learning by teachers for students in Bajawa for mathematics learning is more varied and students know their own culture, and want to preserve the culture of ikat community Bajawa. Researchers who want to do further research is expected to perform more deep data digging so that the data obtained can be varied and more complete.

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