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Ecological Perspective Based on "Asta Bumi" Philosophy

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ABSTRACT

The purpose of this study is to describe the ecological perspective of the people of Megati Traditional Village, Selemadeg District, Tabanan Regency, regarding spatial planning of traditional Balinese buildings based on the Asta Bumi philosophy. This type of research is quantitative descriptive research with a survey method and the Rasch model approach with the help of the WinStep version 3.73 application. The population in this study were heads of families in the Megati traditional village using a random cluster sampling technique. The result is that most people have traditional Balinese building types based on the Asta Bumi philosophy, and the completeness of the buildings still varies. Respondents with low levels of education believe that traditional buildings have been built that way since ancient times and are ancestral heritage. They need to fully understand the ecological meaning of the Asta Bumi philosophy, even though the community has implemented it in building homes and feeling comfortable. Respondents with a higher level of education understand more about traditional buildings. However, they tend to only apply the Asta Bumi philosophy in building houses if they are constrained by land ownership for traditional buildings based on the Asta Bumi philosophy. In conclusion, there are different views on applying the Asta Bumi philosophy between respondents with higher and lower education due to differences in understanding and level of education. So it is necessary to have government policies and related parties to provide a broad and sustainable understanding to the community.

1. INTRODUCTION

Buildings, where humans live, do not just place to take shelter and avoid disasters but also places to interact with fellow human beings in kinship or social bonds. Residential buildings should be made comfortable and safe and accommodate human activities to make people who live in them happy. A good building should never be seen as a personal space but as part of its environment [1]. Buildings that synergize with nature can be seen from their various ecological aspects, such as comfort, good air circulation, avoiding disasters, and not causing hazards such as disease, accidents, and other disasters that can claim lives. The layout of traditional Balinese buildings is one of the community's local wisdom, which is a legacy from their ancestors to create a harmonious bond between residents/humans and nature.

The Balinese Hindu community, in carrying out their daily lives, permanently to the concept of *Tri Hita Karana*, which means the three causes of happiness [2]. where to get happiness, there needs to be a good relationship between humans and the creator (*parahyangan*), humans and others (*pawongan*), and the natural surroundings (*palemahan*) [3]. The Balinese people firmly believe that the individual (*bhuana alit*) does not have his role but must adjust himself to return to the great cosmos (*bhuana agung*), namely the universe. Both have the same forming elements, so the body is sensitive to natural signs [4]. The part of *Tri Hita Karana*, namely *Palemahan*, states that there must be an excellent harmonious relationship between humans and their environment. It can be realized in many ways, such as maintaining cleanliness, holding certain traditional religious rituals that symbolize the balance of nature, and arranging spatial layouts such as the location of shrines and places of worship. Stay for comfort and health and avoid disaster. The layout of residential buildings in Bali is based on *Tri Mandala* as the personification of the universe (*Buana Agung*) in a small scope, including *Utama Mandala/ Parahyangan* (location of sacred buildings), *Madya Mandala/ Pawongan* (location of residential buildings), and *Nista Mandala/Palemahan* (garden/ livestock) [5]. *Tri Mandala* is further expanded by the concept of the sanga mandala as the embodiment of the devata nawa sanga, namely the nine gods in the nine directions of the compass and have their color so that the residential area of the traditional Balinese community is divided into nine parts [6]. The division of these nine areas produces three diagonal areas from southeast to northwest. These three areas in the application are space which has their respective functions. The southeast corner area is used for gardening or animal husbandry, the middle area, called natah, is used for an open area where activities and socializing, and the area in the northwest corner

is a sacred place to ask for environmental safety residence [7]. The *Sanga Mandala* space concept's diagonal space pattern relates to ecology in terms of airflow and circulation. Besides stating the space concept, *Sanga Mandala* can also provide the lighting for each building maximized [8]. One of the basic arrangements for spatial layout in the design of Madya Bali housing is the zonation (regional) arrangement, referred to as the *Asta Bumi* philosophy. This concept regulates the layout of Balinese buildings and designs areas above the ground or earth [9].

Asta Bumi's concept regulates the measure of the distance between one building to another based on a human's elbows or body size, especially the length of the arms (fathoms) and the length of the soles of the feet (footprint) of the head of the family or the owner of the house. Not only the distance between buildings but also the direction of the position and the distance of the exit (order), *Asta Bumi*'s concept regulated the measured in a clockwise direction. This position is *Asta Bumi*'s calculations are believed to determine how the life of the occupants of the house will be, can have a good impact, or can also have a destructive impact. *Asta Bumi*'s philosophy offers artistic value. History has proven that the design helps deal with various local disasters, such as earthquakes, fires, and floods because this concept is rich in philosophical value [7].

However, the Balinese still need to fully implement the *Asta Bumi* philosophy concept in building a place to live due to several things, such as lack of access to information, understanding, and wrong perspectives. Especially in the Megati village, Selemadeg sub-district, Tabanan regency, Bali, where most of the population owns traditional Balinese buildings, they still do not understand the meaning of the spatial concept, especially its ecological benefits. The community only thinks that the concept of spatial planning and Balinese architecture has always been like that because it is a legacy of knowledge from their ancestors without understanding the meaning of the arrangement of the spatial pattern, especially from an ecological point of view. Based on this, it is necessary to strengthen and describe how the ecological perspective of spatial patterns based on the philosophy of *Asta Bumi* is needed for the local community.

The ecological perspective is also intended to gain knowledge about patterns of human interaction with their environment in a sustainable manner and how to inherit traditions. So that will become an inspiration for modern society to be able to maintain environmental sustainability [10], so in the future, it can be helpful in efforts to preserve culture as well as develop housing—sustainable inclusiveness for the convenience of the community, especially the people of Bali. If the spatial pattern of this traditional Balinese building is appropriately implemented correctly, it will provide many benefits such as comfort, health, and avoiding disasters. Maintaining balance with their living areas through the relationship between human life and other living things, as well as processes in the seasonal, weather, and water cycles through community practices, will prevent the over-exploitation of natural resources [11].

2. RESEARCH METHODS

This type of research is explanatory research with a survey method conducted on respondents to obtain data from certain natural places [12]. In this study, the researcher conducted treatment by collecting data using a questionnaire. The research was conducted in the Megati Traditional Village area, Selemadeg Timur District, Tabanan Regency. The choice of research location was based on logical considerations. The Megati traditional village area is where the people still carry out Balinese cultural traditions from Hindu religious teachings, just like other traditional villages in Bali. Another thing is that research has yet to be conducted to map the implementation of *Asta Bumi*'s knowledge in determining spatial patterns and traditional Balinese building architecture in the area.

The population in this study were the Heads of Families (KK) in the Megati Village, Selemadeg Timur District, Tabanan Regency. The sampling technique was random cluster sampling, which was carried out by dividing the population into several clusters based on regionality [13], namely the north-central and southern regions in a transect line. The respondents were randomly selected within the cluster to be included in the study. Data collection techniques in this study used a questionnaire. The research stages are (1) the initial observation stage; (2) the stage of submitting a research permit to the Perbekel (Village Head) and the local Banjar Customary Village; (3) determining research clusters (4) preparing research instruments and (5) conducting research (collecting and analyzing data).

The collected data were analyzed by qualitative descriptive method with the Rasch model approach to describe more clearly what happened between people and the actions taken [14]. The use of the Rasch model approach assisted by the winstep application version 3.73 aims to describe in more detail how the ecological perspective of the community towards the application of the *Asta Bumi* philosophy in the spatial pattern of traditional Balinese buildings, especially in terms of education level and land ownership for residential buildings.

3. RESULTS AND DISCUSSION

3.1 Respondent’s data

The following results were obtained based on the survey results of 105 household head respondents in 3 clusters, namely the northern, central, and southern Megati villages (Table 1).

It can be seen that the majority (64.8%) of family heads are adults, 21.9% of family heads are young adults, and 11.4% are seniors.

This Data indicates that the people of Megati Village are at a productive and mentally mature age to be used as respondents. If seen from the level of education, 61% have a medium level, 21% have a high level, and 20% have a low education level.

The respondent is appropriate and able to understand the questions posed by the researcher and can fill out the questionnaire appropriately.

Ownership of land as a residence also varied, namely 81% classified as narrow land, 12.4% as a medium, and the remaining 6.67% as large land.

Table 1. Respondent's data

Category	Age			Level of Education			Land Area		
	Adult	Young Adult	Senior	Medium	High	Low	Narow	Medium	Wide
Number of Respondents	68	23	12	64	21	20	85	13	7
	64.8%	21.9%	11.4%	61%	21%	20%	81%	12.4%	6.67%

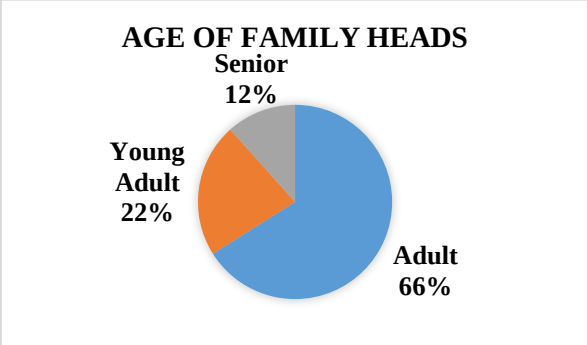


Figure 1. Age of family heads

Figure 1 showed the percentage of ecological perspective based on the age of family heads in Megati Village. The data showed that almost 70% of respondents based on age of the family heads are adults. It means that the respondents are representative of indigenous knowledge in Bali such as *Pemangku Adat*.

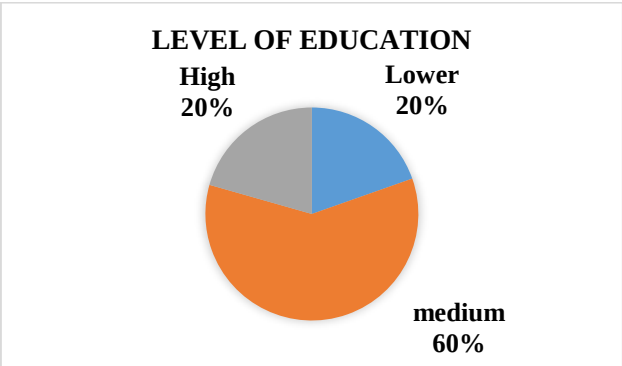


Figure 2. Respondent's education level

Figure 2 showed the percentage of ecological perspective based on the level of education in Megati Village. The data showed that almost 50% of respondents based on the level of education medium level. It means that the level of education of respondents in Megati Village is Junior High School and Senior High School level.

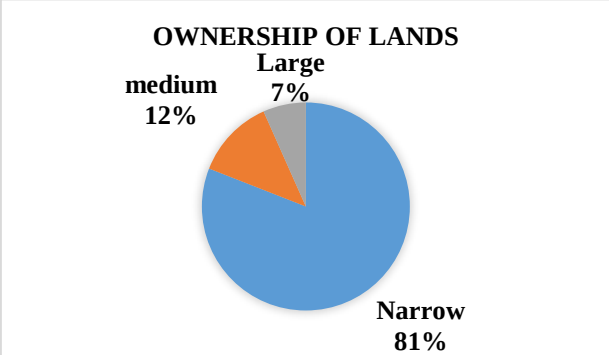
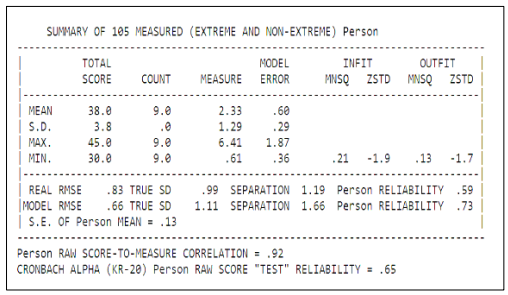


Figure 3. Land ownership by respondents

Data on respondents' land ownership (Figure 3) shows that most respondents have narrow land. Inadequate land ownership for the construction of traditional Balinese buildings proves that people's purchasing power for residential land is low.

If seen based on the analysis of the reliability value of the respondents to the questionnaire items using the WinStep application, it can be seen in Figure 4 as follows.



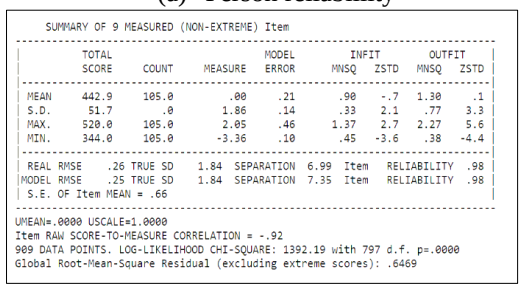
SUMMARY OF 105 MEASURED (EXTREME AND NON-EXTREME) Person

	TOTAL SCORE	COUNT	MEASURE	MODEL ERROR	INFIT MNSQ	INFIT ZSTD	OUTFIT MNSQ	OUTFIT ZSTD
MEAN	38.0	9.0	2.33	.60				
S.D.	3.8	.0	1.29	.29				
MAX.	45.0	9.0	6.41	1.87				
MIN.	30.0	9.0	.61	.36	.21	-1.9	.13	-1.7

REAL RMSE	.83	TRUE SD	.99	SEPARATION	1.19	Person RELIABILITY .59
MODEL RMSE	.66	TRUE SD	1.11	SEPARATION	1.66	Person RELIABILITY .73
S.E. OF Person MEAN = .13						

Person RAW SCORE-TO-MEASURE CORRELATION = .92
CRONBACH ALPHA (KR-20) Person RAW SCORE "TEST" RELIABILITY = .65

(a) Person reliablility



SUMMARY OF 9 MEASURED (NON-EXTREME) Item

	TOTAL SCORE	COUNT	MEASURE	MODEL ERROR	INFIT MNSQ	INFIT ZSTD	OUTFIT MNSQ	OUTFIT ZSTD
MEAN	442.9	105.0	.00	.21	.90	-.7	1.30	.1
S.D.	51.7	.0	1.86	.14	.33	2.1	.77	3.3
MAX.	520.0	105.0	2.05	.46	1.37	2.7	2.27	5.6
MIN.	344.0	105.0	-3.36	.10	.45	-3.6	.38	-4.4

REAL RMSE	.26	TRUE SD	1.84	SEPARATION	6.99	Item RELIABILITY .98
MODEL RMSE	.25	TRUE SD	1.84	SEPARATION	7.35	Item RELIABILITY .98
S.E. OF Item MEAN = .66						

UMEAN=.0000 USCALE=1.0000
Item RAW SCORE-TO-MEASURE CORRELATION = -.92
909 DATA POINTS. LOG-LIKELIHOOD CHI-SQUARE: 1392.19 with 797 d.f. p=.0000
Global Root-Mean-Square Residual (excluding extreme scores): .6469

(b) Item reliability

Figure 4. Reliability of Analysis Person (a) dan Item Reliability (b)

Based on the data in Figure 4, it can be seen that the person measure = +2.33 logit (> logit 0.00), which indicates that the average respondent tends to answer in agreement with various items. Cronbach's Alpha value which measures the reliability between persons and items as a whole shows a number = 0.65 in the excellent category. Item reliability shows a score of 0.98 (> 0.94) above the particular range, which means that the quality of the items in the instrument is very good for use in research.

3.2 Building completeness data

When viewed from the buildings owned, most of the people of Megati village have traditional Balinese buildings (78.57%), and the rest (21.42%) have modern houses. Traditional Balinese buildings, in terms of completeness, are pretty varied. The complete Balinese traditional buildings must at least have a holy place (*Sanggah/Mrajan*) as a place of worship, Bale Daja as a place to live, Bale Dangin as a place for social and religious customs, Bale Delod as a kitchen, bathroom and *Jineng* (rice barn). Data on the completeness of traditional Balinese building types in Megati Village can be seen in Table 2 below.

Table 2. Completeness data of traditional balinese buildings in Megati Village

Traditional building fittings	Number of Respondent	Land Area					
		Narrow (≤ 650 m^2)		Medium (700-1300 m^2)		Wide (>1300 m^2)	
Very complete (18,18%)	12	9	68,75%	2	25%	1	6,25%
Complete (30,30%)	20	13		6		1	
Quite complete (33,33%)	22	20	91,17%	2	8,82%	-	
Less complete (18,18%)	12	11		1		-	
Jumlah	66	53		11		2	

Based on the data in Table 2 above, the completeness of traditional Balinese building types owned by residents is in the categories of sufficient (33.33%), complete (30.30%), to very complete (18.18%), including *bale daja* (bed), *bale delod/paon* (kitchen), *bale dangin* (*bale adat*), *bale dauh*, bathroom, *jineng*, and other building.

At the same time, the rest who have complete buildings are in the less category (18.18%). In Table 2, it can also be seen that 6.25% of respondents who have very complete and complete traditional building types have the land area in the broad category (> 1300 m^2), and 25% of respondents have landed in the medium category (700 – 1300 m^2) and 68.75% of respondents own land in the narrow category (≤ 650 m^2).

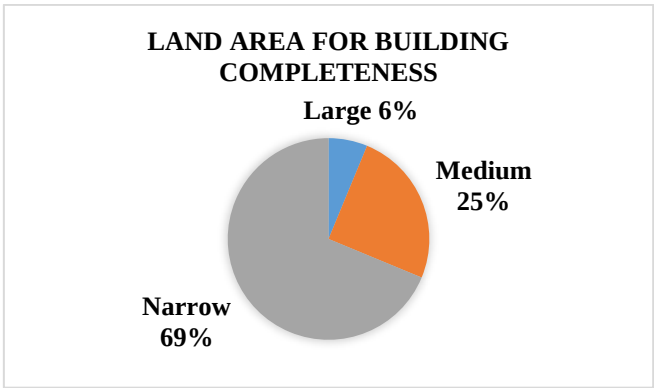


Figure 5. Land area for a very complete and complete category of traditional building

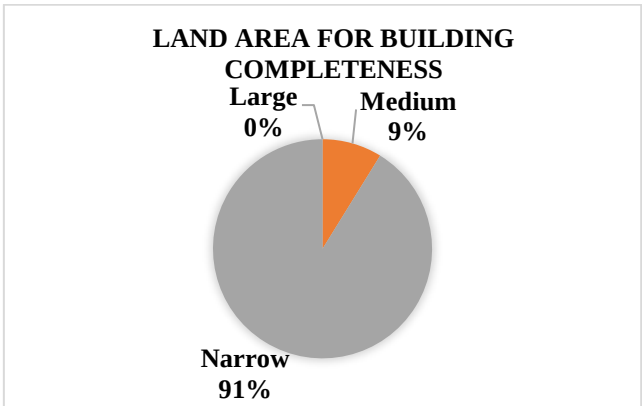


Figure 6. Land area for a quite complete and less complete category of traditional building

Figure 5 showed that almost 70% of the land area for building in Megati Village is completeness models. But, the building area of completeness has a narrow land area. It means that the society in Megati Village has hard knowledge and appreciation of the culture which comes from the ancestors in Megati Village, Bali.

Figure 6 showed that 91% of respondents with quite complete and incomplete buildings tended to have a narrow category of land area, and only 9% had a medium category of land.

The data proves that respondents' incomplete types of traditional Balinese buildings are constrained by land ownership. The ideal land area needed to complete a traditional Balinese building is 1000 m^2. However, in reality, development can be modified and adapted to land conditions and the number of family members but still uses the hulu-teben concept, where the place of worship must be located in the north or east direction with the positions of the other buildings remaining separate. When the place of worship can be placed on top of the main building (2^{nd} floor), challenging to implement, its position remains above a sacred place.

Despite having problems with significant land ownership, most respondents agree with the concept of building spatial patterns using *Asta Bumi*, with the percentage strongly agreeing 33%, agreeing 58%, agreeing 5%, and disagreeing 4%. Most of the respondents who agree with the *Asta Bumi*, even though it requires a large area of land, stated that the *Asta Bumi* is an ancestral heritage that must be preserved. Regarding the area of land needed to build a traditional house based on the philosophy of the *Asta Bumi* concept, there are already rules that determine one of them, elbow natah [15].

3.3 Ecological aspects of traditional Balinese buildings according to community perspective

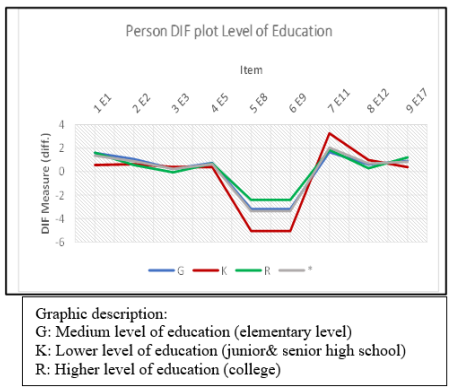
According to the people of Megati Village, the desire to have a complete traditional Balinese building is also related to their pride in the Balinese people. Besides the comfort and peace of mind, there is also a courtyard where the family plays and realizes that the spatial pattern with the *Asta Bumi* philosophy can also be used as a rainwater catchment area. Most respondents felt comfortable with the concepts and philosophies of traditional Balinese building layouts based on *Asta Bumi*, with the percentage answering very comfortable 40%, comfortable 56%, and quite comfortable 4%. No respondents stated they were uncomfortable. As many as 81% of respondents answered that they were comfortable with the layout of traditional Balinese buildings, which are based on *Asta Bumi* because the distance between buildings is wide enough to provide more space for free movement so that air circulation becomes good. The remaining 14.3% thought that traditional Balinese spatial planning was like that. The rest do not know. Local knowledge passed down from generation to generation is invaluable to the local community and reflects the importance of local wisdom [16] for the survival and comfort of the local community. Based on the investigation of respondents who disagreed with building spatial patterns using *Asta Bumi*, all were heads of households and had high school/equivalent education with narrow land ownership status. If we look further at the level of community education, there are differences in responses between respondents with high, middle, and low education levels, which are presented in Figure 7.

TABLE 30.4 C:\Users\BASKARA\Desktop\aspek ekolog ZOU407WS.TXT Dec 8 9:42 2022
INPUT: 105 Person 9 Item REPORTED: 105 Person 9 Item 5 CATS WINSTEPS 3.73

DIF class specification is: DIF=$S5W1

Person CLASSES	SUMMARY DIF CHI-SQUARE	D.F.	PROB.	BETWEEN-CLASS MEAN-SQUARE	t=ZSTD	Item Number	Name
3	9.4746	2	.0085	1.8779	1.0345	1	E1
3	2.4856	2	.2851	.4745	-.3267	2	E2
3	.7317	2	.6922	.0781	-1.3845	3	E3
3	.8423	2	.6544	.1486	-1.0776	4	E5
2	1.4586	1	.2272	.4577	-.0151	5	E8
2	1.4586	1	.2272	.4577	-.0151	6	E9
3	18.1578	2	.0001	4.4824	2.2798	7	E11
3	2.5495	2	.2761	.3466	-.5593	8	E12
3	3.5779	2	.1645	.4839	-.3114	9	E17

Figure 7. Table of research item bias



Graphic description:
G: Medium level of education (elementary level)
K: Lower level of education (junior& senior high school)
R: Higher level of education (college)

Figure 8. Item bias analysis toward education level

Figure 7 above shows that items with codes E1 and E11 have a probability value below 5%. The data indicate a significant difference in response to item items with code E1 which states the suitability of the shape of a house building with the Astabumi philosophy, and item E11 which states the public's perception of earthquake-resistant building structures. For more details, it can be seen in the graph of Figure 8 as follows.

Figure 8 shows that when viewed from the level of education, there is a bias in items E1 and E11. In item E1, which states the conformity of the shape of the house building with the philosophy of Astabumi, respondents who have a higher level of education (college) have lower scores compared to respondents who have a low to medium level of education. The respondent with a higher level of education chooses to leave the application of the Astabumi concept in the layout of residential buildings. Respondents with bachelor's and master's education levels who study in cities tend to have different perceptions about applying the *Asta Bumi* concept. The respondents think applying the *Asta Bumi* concept is less critical, as cooperation and Simakrama (hospitality) have been preserved in rural areas. This shift is a form of community social adaptation adapted to the community's natural social and economic conditions [17]. In urban areas, is that the limited amount of land owned as a place to live and the high price of land in urban areas make it difficult to implement spatial and building patterns that comply with the provisions of *Asta Bumi* [18] because requires a small amount of money. Respondents with a higher level of education think that a comfortable place to live does not have to be based on the *Asta Bumi* philosophy, even though they are fully aware of the ecological benefits of development based on the *Asta Bumi* philosophy. Item E11 states that the buildings that suffered the most damage were even destroyed because the building structures were less earthquake resistant. In contrast, respondents with a higher education level tend to agree that if an earthquake destroys a building, it is the result of the building structure, which is not earthquake resistant.

Respondents with higher education have better access to knowledge of traditional Balinese building architecture, which uses more pegs and wood with high flexibility so that traditional buildings are more resistant to damage when an earthquake occurs than modern buildings with low-cost construction. In traditional buildings, pin connections are used, which according to Felix (1999), have an efficiency level of 60% and are better than bolt connections which have an efficiency level of 30%. Types of light and flexible materials, such as wood and bamboo, have a low water content, can withstand compression, and be used as supporting materials in green architecture [19]. Traditional walls are detached from the building frame construction, which is reinforced with a gap between the head of the wall and the underside of the roof so that the free wall does not carry in the hope of avoiding danger. Traditional buildings are built with rigid frame construction and other frame parts. The relationship between the structural elements is done with hooks, wedges, and rigging systems, which are earthquake-resistant structures and constructions needed for buildings where earthquakes frequently occur [20].

Respondents with low to medium education tended to express disapproval of buildings destroyed by earthquakes caused by building structures that were not earthquake resistant. Respondents with lower levels of education tend to think that buildings that are not earthquake resistant are because they are weathered and aged. Respondents with lower levels of education tend to need help understanding the traditional Balinese building structures, which are made to protect themselves from natural disasters such as earthquakes. The questionnaire results stated that 95% of the respondents stated that there was no damage to their house even though several earthquakes hit it, and 5% stated that it was only lightly damaged. The minor damage was to the weathered bale delod/kitchen building because they are aged. Respondents with lower levels of education tend to have less understanding of the ecological meaning of *Asta Bumi* knowledge, whereas spatial planning using the *Asta Bumi* philosophy will impact disaster mitigation, such as earthquakes, floods, and fires.

Building has direct and indirect effects on human health [21]. Open space with separate buildings by the provisions of the cardinal directions, apart from providing comfort, will also make it easier for the community to evacuate themselves in the event of a natural disaster such as an earthquake. The hulu-teben system also allows houses to avoid flooding. If a fire occurs, not all buildings are affected because the positions of the buildings are separated and spaced apart. Placing the kitchen area, bathroom, and livestock area, which are separate from the residence, will positively impact comfort and health. Separate buildings will avoid foul odors, germs, viruses, and fungi that cause disease and not directly coming into contact with the living area rest and going about daily activities. Separate buildings can also be a solution for addressing physical distance during the Covid 19 pandemic. Traditional building designs are also considered more adaptable because of its reliance on separate rooms. So it is recommended to have a multipurpose room in the future with traditional guest room designs, which is a separate room, with a separate bathroom, and a separate entrance for flexibility with a minimal interior design, to be able to reduce costs required for development

[22]. Even though the pandemic is over, the concept of a separate building like the *Asta Bumi* philosophy can be applied to building concepts in the future.

4. CONCLUSION

Based on the study results, most of the Megati village community already has traditional Balinese buildings based on the *Asta Bumi* philosophy. However, in terms of the completeness of the buildings, they are pretty varied. Even though they have implemented the *Asta Bumi* philosophy in building traditional Balinese houses, most of the people of Megati Village need to be fully aware of its ecological benefits, especially those with low and middle education levels. People with low levels of education think that the concept of Balinese houses must follow what was passed down by the ancestor because it is an ancestral heritage that must be preserved. People think that if there is damage during an earthquake, it is not because the building structure is not earthquake resistant but because the building is weathered and old. Although they understand the ecological benefits of traditional buildings based on Astabumi, respondents who have a high level of education tend to build houses based on something other than the Astabumi philosophy. Apart from the increasingly limited land, the high price of land also makes respondents with higher education levels think twice about building a place to live based on the philosophy of *Asta Bumi*. This research is limited to describing the people's perspective in Megati Village about the ecological benefits of traditional Balinese buildings based on the *Asta Bumi* philosophy. The benefits from this research will provide an opportunity for other researchers interested in researching the same thing. Another researcher can expand the scope of research to the Balinese community in general so that they can contribute knowledge and a more comprehensive picture in determining the direction of government policy toward the preservation of traditional buildings and return on an ongoing basis.

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