Analysis of Factors that Affecting the Activities of Anoa *(Bubalus depresicornis and quarlesi)* Hunting in Donggala District, Central Sulawesi

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Abstract

Wildlife hunting activities, especially Anoa were still done by the community at Sibado Sirenja village, District Donggala District. This activity is conducted to determine the factors that cause the activity of Anoa hunting activities in the community level in increasing household income and food fulfillment. Therefore, the purpose of this study is to determine the factors that influence the occurrence of Anoa hunting activities. The research used descriptive verification method through Structural Equation Modeling (SEM) analysis, data analysis was done with Partial Least Square and SmartPLS software. The result of analysis obtained by determinant coefficient (R^2) variables that influence the development of Anoa is the rise of Anoa hunting (Y1) equal to 0623 with value of t-statistic 13,203 and preservation of Anoa (Y3) equal to 0,661 with t-statistic value 13.837 and regulation strategy Y2) 0.600 value of t-statistic value of 7,817. Latent variables that influence the hunt were economic (X1), health (X2) and social culture (X3). The value of R^2 of Anoa hunting (Y1) of 0.623 indicates that the variable can be explained by economic variable (X1) with p-value 0.074 (74%), health with p-value 0.566 and social culture with p-value 0.033. Anoa preservation variable (Y3) can be explained by economic variable (X1) with p-value equal to 0.108, health (X2) p-value of 0.835 and socio-cultural variable (X3). While the variable of regulation strategy (Y2) can be explained by exogenous economic variable (X1) with p-value equal to 0.962, health variable (X2) with p-value equal to 0.835 and socio cultural variable (X3) with p-value 0.175.

Keyword: Community, Hunting Activity, Anoa

1. Introduction

Conceptually this research would get an explanation about the constellation of human interest and its effect on hunting Anoa in Central Sulawesi, especially in Donggala District including the dynamics that happened. The study of Anoa includes problems relating to the activities of community hunting activities in meeting the needs of animal protein and increasing family income.

The current problems in Donggala District nowadays is the activity of hunting Anoa to fulfill the needs of animals for the household and also as a side income of the community around the forest area. A similar case was reported by Pattiselanno et al. (2008) in Papua that the hunting of animals by the community not only contributes to the fulfillment of family animal protein intake, but also an alternative source of income for rural households. These hunting activities not only increase people's incomes, but on the other hand can be detrimental or affect the decline of the Anoa population. According to Robinson & Bodmer, (1999), the wildlife hunting is a traditional part of the local economic and cultural aspects of the tropics and hence is considered sustainable. Various efforts have been made by the relevant agencies to the activities of hunting activities, but until now the hunting activity is still practiced, so it is interesting to be studied more deeply related to factors that cause activity of hunting activity by society in Donggala Regency, Central Sulawesi.

Data and information on the Anoa hunting of in Central Sulawesi, especially Donggala District, is still very under-reported. In fact, the data is indispensable as the foundation of local government as a reference in making local product regulation strategy that is able to support government regulation in supporting Anoa breeding program, so that one of endemic animal wealth can be used as tourism mascot and can preserve Anoa population from threat of extinction in Donggala District.

2. Research Methods

This research is an approach of natural resource economics which focuses on behavioral science of society and human resource management, especially analyzing variables of Anoa hunting widespread, regulation strategy and preservation of Anoa associated with Anoa development in Sibado Village, Sirenja District, Donggala District, Central Sulawesi based on Purposive sampling.

This study was conducted to obtain information on hunting activities on the influence of policy regulation and its implications on the Anoa hunting control program in Donggala District. In accordance with the

above purposes, the type of research used is descriptive and verificative, and case studies because this study aims to test the answers of problems that are temporary (hypothetical) based on a particular theory or empirical data (Nazir, 2003). This research uses survey method that is observing directly in the field, whether related to object, occurrence, process of relation and condition of society, and natural environment related to research purpose (Adimihardja & Hikmat, 2004), then sampling of respondent using random sampling method based on Mantra's reference, (2003).

The analysis design of this research refers to the purpose of research that is descriptive method verified using tool analysis of Structural Equation Modeling (SEM) or Partial Least Squares (PLS). Where in this formulation approach is integrated several factor analysis, structural model and path analysis, which can be done by three activities simultaneously namely, validity and reliability test of instrument (equivalent factor of confirmatory analysis), testing of relation model between latent variable (equal to path analysis), and derive useful models for forecasts (equivalent to structural and regression models), (Solimun, 2002). In the Structural Equation Model (SEM) analysis, the number of samples taken from the population was determined at 5-10 times the number of indicator variables used in the analysis design, the sample size ranged from 0 to 100 (Hair et al., 1998, and Ferdinan, 2003) then the questionnaire will be circulated a number of 100 questionnaires.

This research using first order confirmatory model will be tested the influence of model built with SmartPLS program version 3.0 seen from loading factor value from each construct in measurement of Outer Model (measurement model). The research design that will be used in this research is hypothesis testing to prove that exogenous economic variable (X1), health (X2), and socio-culture (X3), influence on endogenous variable of hunting (Y1), regulatory strategy (Y2) and conservation anoa (Y3). To find out how the relationship of each variable studied it will explain the object under study.

3. Results and Discussion

3.1. Profile of Hunting in Central Sulawesi

Data on hunting activities are still poorly reported and not even exist in each related agency in Central Sulawesi. Reports on the results of the activities of Immunization NGOs still report related socio-economic activities related to forest and wildlife utilization in Donggala District is presented in Table 1. Type of fauna or wildlife has been widely used by the community in several villages in Donggala District. Factors that underlie the existence of hunting activities at the community level are: 1. Utilization of meat for the needs of animal protein household; 2. Pets; 3. As a tourist attraction as well; 4. As traditional medicines.

One example of wildlife utilization is the deer, which is widely used for commercial purposes, because it has potential economic value. The economic value of the deer can be used as a producer of meat, skin, and horns. Deer in Indonesia that have a chance to be cultivated, consisting of several types of *Cervus timorensis* which has eight sub-species, *Cervus* unicolor two sub-species, and deer spotted (Axis-axis) which is the type of deer from India which is now well developed in Bogor Palace. (Mustari, 1997).

Table 1. Wildlife Utilization Activity In Donggala District, Central Sulawesi

Village	Intensity	Tools	Kind of hunted wildlife	Usage	Price for each (Rp)	Sales Source
Bale	often	1. Spear 2. Cleaver 3. Dog 4. rifle	1.Wild Boar 2. Wild Chicken 3. Deer	1. Selling 2. Selling 3. Consumption	1. 250,000 2. 65,000	- Palu Town - Neighbor
Sibado	Seldom	1. Trap 2. Spear 3. Cleaver 4. Dog	1.Anoa, 2. Wild Boar 3. Deer	1. For Sell 2. For Sell 3. For sell and Consumption	1. 250,000 2. 65,000	- Penada from manado - Neighbor
Tovia Tambu	Often	1. Trap 2. Spear 3. Cleaver 4. Dog 5. Bait	1. Wild Boar 2. Wild Chicken	1. Consumption 2. Consumption & Selling	15,000/kg	- Neighbor
Sioyong	Seldom	1. Trap 2. Spear 3. Cleaver 4. Dog.	1. Deer 2. Wild Boar	1. Consumption 2. Killed	-	-
Pani'i	Often	1. Trap 2. Spear 3. Cleaver 4. Dog	1. Wild Boar 2. Anoa 3. Deer	1. For Sell 2. For Sell 3. For sell and Consumption	1. 250,000 2. 450.00	- Penada from manado - Neighbor
Samalili	Often	1. trap 2.Bait	Wild Chicken	Consumed & petting		-

Source: Cantral Sulawesi immunity 2015

Based on Table 1 above, obtained the types of wildlife used by the community in some villages located in Donggala District. The type of wildlife that is used by the community in hunting activities are: 1. Wild Boar (Sus Celebensis); 2. TImoer Deer (Cervus timoerensis); 3. Anoa (Buballus depresicornis and quarlesi); 4. Wild Chickens (Gallus-gallus).

The utilization of wildlife by the community, in addition to being used for the fulfillment of household needs, is also used for the benefit of the addition of the family economy. People in the Bale village, wildlife such as wild boar (Sus celebensis) and wild chicken (Gallus-gallus) are usually sold to containers located in Palu City, while deer (Cervus timoerensis) is used for household consumption. While the village of Sibado and Panii Village, the hunts are sold to penadah from Manado City and neighbors around the village. For Tovia Tambu Village the results of more dominant hunting activities are sold to the neighbors around the house. According Pattiselanno, (2007) that the people who inhabit the coastal region, living from the mercy of nature by mixing, hunting, farming. Hunting and extracting wildlife from nature has been a hereditary activity and continues to be practiced to date, because it is one of life's important aspects and is an integral part of its social environment.

3.2. Anoa Size Characteristics

Tabel 2. Anoa Characteristics at Research Location

Age	Size	Highland Anoa (*Bubalus quarlessi*)
3.5	Body Size	Smaller size that other kind of Anoa
	Horn	Elongated conical and black striped
	Weight	50 Kg
	Lenght	52 cm
	Height	49 cm
	Head height	7.5 cm
	Neck Lenght	17
	Horn Lenght	8 cm
	Color	Bright brown with a slightly coarse fur and a slim body. Neck bristles are circular.

Description: Survey Result 2016

Based on observations and measurements of body size, it was found that the species found were Anoa (Bubullus quarlesi) highland. This is reinforced by the opinion of Groves, (1969) which states that the adult body size of the Highland Anoa was 80 - 100 cm, while the measurement results obtained height of 49 cm, presented in Table 2.

According to Mustari, (2010) the average height of an adult Anoa is only 75 centimeters. There are only 69 centimeters but there reaches 106 centimeters. Maximum weight anoa was 150 kilograms. Anoa children with thick brown hair, while the older Anoa, has darker hair of dark brown to black. Male Anoa is darker. The taxonomic form of Anoa body resembles a dwarf cow, Anoa species is composed of two types: low-dose Anoa (Bubalus depressicornis) and highland Anoa (Bubalus quarlesi).

The Anoa body length is 160 - 172 cm and the tail is 18 - 31 cm, while the highland Anoa is usually smaller. The general description of the Anoa body shape (Buballus quarlesi) is not much different from the statement of Groves (1969) which the highland Anoa is relatively smaller than the Anoa found in the lowlands. Head shape resembles a cow's head (*Bos*), legs and nails resembling a bull (*Bos sondaicus*). On the front leg (*metacarpal*) is white or like Balinese cow but has a black line down. The horn leads backwards, resembling a cross section of which is essentially not round like a cow horn but resembles a triangular wake like a buffalo horn.

Based on Figure 1 above, some samples were found at the study site, the average skull was a low-altitude anoa with the size of the skull or the size of the horn that has a diversity, although not much different for each sample. The average length of horn size ranges from 6 cm to 12.5 cm with a width ranging from 2.5 to 7 cm. While the average size of the skull length ranged from 15 - 21.2 cm with a head skull width of 7 - 7.2 cm.

Based on the results of Arini's report, (2013), the size for a horn lowland Anoa ranges from 18.5 to 29.5 cm. As for horn plateau Anoa ranged between 17 to 18 cm. According to Groves, (1969) that the length of the lowland Anoa horns ranges from 27-37 cm, whereas for females 18-26 cm, as well as for highland Anoa, the length of the horns is 15-20 cm while for females between 15 to 20 cm.

Category: Adult Male
Species: Babalus Depressicornis
Location: Sibado Village
Horn length:
Right: 12.5 cm
Left: 12.5. cm
Horn width: 7 cm
Head bone Length: 17.6 cm
Head Bone Widht: 7 cm

Description:
The bone was white colored before, but the community colored the bone in blue to keep it from broken and smell. The line under the eyes (sutura) Indicates the adultness.

Category: Adult Male
Species: Babalus Depressicornis
Location: Sibado Village
Horn length:
Right: 9.8 cm
Left: 10 cm
Horn width:5 cm
Head bone Length: 21.2 cm

Description:
The bone was white colored with the sutura lines split from the nose until the eyes. Up the forehead was also found so many sutura which categorized as the adult Bone.

Category: Adult Female
Species: Babalus Depressicornis
Location: Panii Village
Horn length:
Right: 6.5 cm
Left: 9 cm
Horn width: 2.5 cm
Head bone Length: 15 cm
Head bone width: 7 cm

Description:
The bone still in the new condition , found so many black brownie colored hair on the skin. The bone was also covered by the skin and the nose was still covered by meat.

Figure 1. Bone Sample was found at research location

3.3. Respondents Characteristics

Tabel 3. Respondents Characteristics

No.	Characteristics	Sibado Village	
		Quantity (Person)	Percentage (%)
3	Hunting Experience:		
	< 10 years	12	13.04
	10 -20 years	37	40.22
	> 40 years	43	46.74
4	Income from ravin		
	< 1 million	21	22.83
	1 to 2 millions	59	64.13
	> 2 millions	12	13.04
	Total	92	100.00

Source: Processed Data 2017
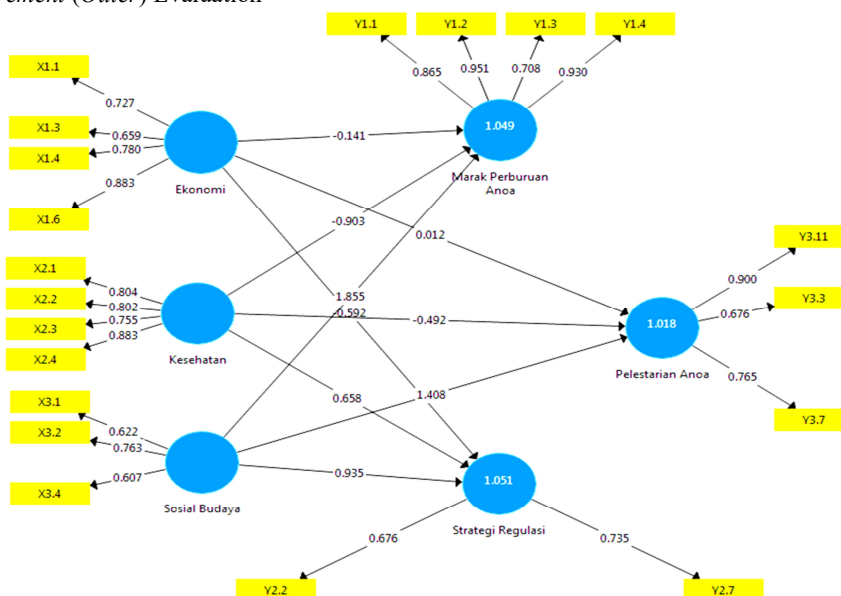
3.4. Model *Measurement* (*Outer*) Evaluation

Figure 2. Loading Point Factor Diagram

Tabel 4. R Square Value

Variable	R Square
Y1	0.623
Y3	0.661
Y2	0.600

Description: SmartPLS Data Processing Result, 2017

After that, the structural model is evaluated by looking at the R-square value which is a goodness-fit test model, to find the answer to the hypothesis proposed in the research by showing the t-statistic value and the R-square value (Table 20). The result shows the value of R-square on variable Y1 is 0.623. This means that community hunting activities have a strong effect. Similarly, the value of R-square on the variables Y3 and Y2 has a value of 0.661 and 0.600 which means to give a positive influence or included in the strong category. This result explains that community hunting activities are influenced by socio-cultural and economic factors in meeting household needs. On the other hand, the policy of hunting and preservation of Anoa gets socio-cultural and economic support through the maintenance of Anoa by people outside the region (ex-situ).

3.5. Hypothesis Testing

Hypothesis test will be done with alpha level 0,05 and t-table = 1.96. The research hypothesis which is tested states that there is a positive direct effect of Anoa development activity on the rise of hunting. The statistical hypothesis to be tested is: H0: γiηξi> 0: and H1: γiηξi <0. The result of structural model analysis is evaluated by looking at R-square value and it is known that this research model is moderate on the proposed hypothesis.

Tabel 5. Path Coefisien (Mean, STDEV, T-Statistics)

Variabel	Orginal Sampel (O)	Standard Deviasi (STDEV)	T-Statistics (|O/STERR|)	Ket
Economics (X1) -> Rampant Hunt (Y1)	0.376	0.106	3.549	Accepted
Economics (X1) -> Anoa Conservation (Y3)	0.372	0.113	3.300	Accepted
Economics (X1) -> Regulatory Strategy (Y2)	0.043	0.168	0.253	Rejected
Health (X2) -> Rampant Hunt (Y1)	-0.135	0.099	1.367	Rejected
Health (X2) -> Anoa Conservation (Y3)	0.058	0.096	0.599	Rejected
Health (X2) -> Regulatory Strategy (Y2)	0.517	0.129	4.010	Accepted
Social Culture (X3) -> Rampant Hunt (Y1)	0.581	0.103	5.625	Accepted
Sosial Budaya (X3) -> Anoa Conservation (Y3)	0.454	0.128	3.558	Accepted
Culture (X3) -> Regulatory Strategy (Y2)	0.272	0.132	2.100	Accepted

Description: SmartPLS Data Processing Result, 2018

Table 5 above shows the relationship between economic factors has a positive and significant impact on the rise of Anoa hunting activity with t-statistics of 3,549 (> 1,96) and the original sample estimate is positive 0.376. at a confidence level of 5%. Hence the hypothesis is **accepted**. This means that the activity of hunting Anoa by the community is influenced by the factor of need for an increase in household income of the community. The results of this study are in accordance with the results of research conducted by Pattiselanno, (2006) in the Papua region. The result of economic factor test have positive and significant effect to the Anoa preservation program in the research location, with the estimate value of sample estimate 0.372 and t-statistic of 3,300> (1.96), so that the hypothesis is **accepted**. These results indicate that the influence of economic factors support the management and conservation of Anoa program at the rural community level to support the Anoa conservation program. The result of economic factor test has negative and insignificant effect on the plan of applying regulation strategy of Anoa development by society in rural area. This is indicated by the original value of the sample shown 0.043 with the t-statistic 0253 <(1.96), so the hypothesis is **rejected**. These results indicate that the Anoa development regulation strategy does not positively affect the 5% confidence interval. This means that the regulatory strategy is still providing opportunities for the community in doing Anoa hunting activity.

Result of health factor test have negative and insignificant effect on the rise of anoa hunting, this result is shown with original sample sample coefficient value is -0.135 and t-statistic value is 1,375 (<1,96). This result can be assumed that health factor does not give effect to the activity of hunting anoa, but on the other side there is positive relation between both variables, so hypothesis is **rejected**. This means that the food fulfillment factor for households in the need for meat products that cause the activity of Anoa hunting activity in the research location. Result of health factor test has positive but not significant effect to anoa preservation program. This result is shown with original sample coefficient value of 0.058 and t-statistic value of 0,599 (<1,96), so hypothesis declared **rejected**. This means that health factors contribute to the anoa conservation program in the research sites, but cannot stop the activities of hunting anoa by the community, this is caused because the activity activities are used to meet the needs of households in addition to improving the economy of the community. Result of health factor test give positive and significant influence to the implementation of regulation strategy of anoa development in research location. This result is shown with original estimate coefficient value of 0.517 and t-statistic value is 4,010 (> 1.96), so it is stated that the hypothesis is **accepted**. This means that health factors get a response or community support in the forefront of anoa development regulation strategy in the research location.

The result of socio-cultural factor test gives positive and significant influence to the activity of hunting anoa. This result is shown by original coefficient value estimate of 0.5810.581 and t-statistic value of 5.625 (> 1.96), so it is stated that the hypothesis is accepted. This means that the activities of community-based anoa hunting activities will be based on the need for household consumption, religious holidays and other traditional events. The result of socio-cultural factor test gives positive and significant influence to anoa preservation program in research location. This result is shown by the original coefficient value of sample estimate of 0.454 and the t-statistic value of 3.558 (> 1.96), so it is stated that the hypothesis is accepted. This means that conservation program activities in the form of raising anoa at community level can provide an opportunity to increase economic income in addition to fulfilling the need for meat product.

The result of socio-cultural factor test gives positive and significant influence to the implementation of

regulation strategy of anoa development at community level. This result is supported with original value of sample estimate obtained 0,272 and t-statistic value 2,100 (> 1.96), so the hypothesis is accepted. These results indicate that the plan to implement anoa development regulation strategy can be one method in controlling the hunting rate conducted by communities around the forest area. This result is consistent with the results reported by Pattiselanno et al. (2008).

4. Conclusions And Suggestions

4.1 Conclusions

       Structural model testing results using SmartPLS 3.0 indicate that the model built in the research is fit but from the results obtained against hypothesis testing proposed not all hypotheses are acceptable, some are not accepted. The results of the above tests and analyzes, concluded several things, such as:

1. The influence of economic and socio-cultural factors contributing positively to the rise of anoa hunting is positive and significant, however, the health variables have a negative and insignificant effect
2. On the economic and socio-cultural variables on the preservation of anoa is positive and has a significant effect on the health variable is positive but not significant
3. The health and socio-cultural relationship to the regulatory strategy is positive and has a significant effect on the economic variable is positive but not significant.
4. The health and socio-cultural relationship to the regulatory strategy is positive and has a significant effect on the economic variable is positive but not significant.

4.2 Suggestions

1. Based on the results of the research, it is expected that the Donggala District Government can consider the anoa policy development policy in Donggala District as one of the community-based tourism icons. In addition, the development of anoa by involving the community in maintenance processes outside the region can increase household economic income, as well as the leading edge in safeguarding and preserving one of Sulawesi's endemic animals from extinction.
2. The plan for applying the regulatory strategy can be used as a method of controlling the rate of hunting.

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