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The Empowerment of Communities around the Forest of Bawean Island Animal Preserve for the Rescue of Bawean Deer (*Axis Kuhlii)*

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Abstract : *The objective of research is to understand the empowerment given to the communities who live around Bawean Island Animal Preserve for the interest of rescuing Bawean Deer (axis kuhlii). Relevant to this objective, research is descriptive with hypothesis testing. Descriptive research is aimed to obtain information about variables related to the conditions of communities around the forest, the natural resource, and the role played by government on the proliferation and rescue of Bawean Deer. Some hypotheses are tested with variable indicators and also examined within regression relation comprising of structural relation in order to recognize which variable with direct effect or which one with indirect effect. Hypothesis verification is using SEM (Structural Equation Modeling) supported by a software AMOS Version 4.0. Research location is the Bawean Deer Conservation Forest in Bawean Island. The allocation of time for research is 10 months starting from 30 August 2014 until 23 June 2015. Reason behind the selection of research location is that it is the only Bawean Deer Conservation Forest in Indonesia. Bawean Deer proliferation is affected by two factors, namely community condition around the forest and natural resource. Government role is not influencing Bawean Deer proliferation. Bawean Deer rescuing model is improving Bawean Deer proliferation sector by empowering communities around the forest and utilizing natural resource.*

Keywords: *Bawean Deer rescuing, animal preserve, community empowerment, Bawean Island*

I. Introduction

The decline of population growth stimulates some efforts for conservation. Among other is Bawean Island Animal Preserve extended to 3,831.6 Ha that is founded since 1979. Besides, one effort to save Bawean Deer from extinction is by captivity which aims to preserve and increase Bawean Deer population. The communities around the forest play very strategic role in keeping the beneficial function of the forest for immediate locals. Forest farmers need to be empowered and given serious attention because forest function is definitely crucial for the supply of water, oxygen, and also flora and fauna. Species extinction is a natural event, but human infiltration may accelerate species extinction. Indeed, extinction begins when a species fails to replace individuals that go to death. Such failure is caused by stressful force or through the entry of new element into the existing environment. As shown by this overview, research is entitled with “The Empowerment of Communities Around the Forest of Bawean Island Animal Preserve for the Rescue of Bawean Deer (*Axis kuhlii)*”. Research attempts to understand factors influencing Bawean Deer proliferation, the effect of Bawean Deer proliferation on Bawean Deer rescue, and the model of relationship between community empowerment and Bawean Deer rescue.

II. Material And Methods

Method of research is case study, whereas data collection involves observation and interview.

Data Collection Method

Relevant to this objective, research type is descriptive equipped with hypothesis testing. Descriptive research is designated to obtain information on several variables such as the conditions of communities around the forest, the natural resource, and the role played by government for the proliferation and rescue of Bawean Deer. Hypotheses are tested using indicators (indicator variables) and also examined with regression relation comprising of structural relation in order to recognize which variable with direct effect or indirect effect. Hypotheses are verified with SEM (*Structural Equation Modeling*) supported by AMOS Version 4.0 software. Research is located at the Bawean Deer Conservation Forest in Bawean Island. The allocated time for research is 10 months starting from 30 August 2014 to 23 June 2015. Reason behind the selection of research location is that it is the only Bawean Deer Conservation Forest in Indonesia.

Data Analysis

Validity and reliability tests are conducted using SEM with LISREL software. Model compatibility in SEM method can directly explain the result of validity and reliability tests. Both tests are helpful to ensure if indicator variables can measure latent variables. According to Bollen (1989) in Sitinjak and Sugiarto (2006), the validity of questions that represent indicator variables in measuring latent variables is valued by seeing whether its loading factor is obvious or not, or in other words, whether it has t-value more than critical (1.96 at significance level of 5 percents).

Structural Equation Modeling (SEM) is used to analyze the relationship between the condition of communities around the forest, the natural resource and the government role as independent variables, with Bawean Deer proliferation and Bawean Deer rescue as dependent variables. LISREL 8.8 Software is utilized for data analysis and data processing. One advantage of SEM is its capacity to measure a relationship that is hardly directly measured (Ghozali and Fuad, 2005). In this case, the condition of communities around the forest, the natural resource, and the government role cannot be measured directly. Bawean Deer proliferation and Bawean Deer rescue are also unable to measure directly. Such situation brings all these variables to be labeled as latent variables.

SEM involves several steps such as following:

1. Developing the model based on concept and theory

In this stage, deep theoretical review is carried on to examine the effect of Bawean Deer proliferation and Bawean Deer rescue. Also in this stage, both latent and indicator variables are secured based on theory.

2. Constructing path diagram

In this stage, both latent and indicator variables are plotted into path diagram to understand the relationship of both variables.

3. Converting path diagram into structural model.

In this stage, structural model and measurement model are described more clearly.

4. Selecting input matrix

In this stage, input matrix is selected and embedded into the formula.

5. Building standard solution model and evaluating goodness of fit index.

In this stage, input matrix is processed, and goodness of fit index from standard solution model is examined.

The following measures may be useful as the guides for SEM-relevant modeling:

a. Chi-Square and probability (P) rates

Attesting how close the estimated resultant matrix is with the original data matrix is using Chi-square. Good model shall have chi-square rate smaller than its degree of freedom.

b. P-value

The expected p-value is greater than 0.05 or 0.1, meaning that it passes obvious test. If result of test is not obvious, it means that input matrix and estimation matrix is not different or in other words, similar, and thus, the proposed model is compatible. P-value is usually ranged between 0 and 1. Structural equation modeling is getting better if p-value approximates to 1.

c. Root Mean Square Error of Approximation (RMSEA)

RMSEA measures the proximity of a model to the population. RMSEA can determine the compatibility of model, which is good if the rate is less than 0.1, and bad if it is more than 0.1.

d. Goodness of Fit Index (GFI)

This measure explains how far the model can explain data variance. The bigger index means the better the model is. Minimal boundary of 0.9 is used as the reference to say that a variable is feasible enough.

e. Adjusted Goodness-of-Fit Index (AGFI)

AGFI is a modification of GFI which accommodates the degree of freedom of the proposed model and the other models to compare with. The rate of 0.8 is the reference to say that a model is feasible enough.

Manifest indicators are arranged from the factors causing Bawean Deer proliferation and Bawean Deer rescue using LISREL 8.80 (Linear Structural Relationship) Software.

The answers from respondents that conform to the predetermined variable rate are then analyzed using structural equation modeling (SEM) facilitated by AMOS 4.0. According to Ferdinand (2002: 6), Structural Equation Model (SEM) is a set of statistic techniques to facilitate the testing of a set of "relatively complex relationships" in simultaneous way. Ghozali (2004: 5) explains that structural equation model comprises two parts, respectively (1) the measurement part which combines observed variables with latent variables through confirmatory factor model and (2) the structure part that connects latent variables through simultaneous regression equation. AMOS is the abbreviation of Analysis of Moment Structure (Ferdinand, 2002).

Identification of Variables

Exogenous latent variables, endogenous latent variables and indicator variables, as well as items examined from theoretical model, are elaborated in Table 1.

Table 1 Exogenous latent variables, endogenous latent variables and indicator variables that are considered in research variable measurement.

No.	Latent Variables	Indikator Variables
1	The Condition Of Communities Around The Forest (X1)	a) Education ($X_{1.1}$) b) Awareness ($X_{1.2}$) c) Perception ($X_{1.3}$) d) Attitude ($X_{1.4}$)
2	The Natural Resource (X2)	a) Land Width ($X_{2.1}$) b) Grass Stock ($X_{2.2}$) c) Water Source ($X_{2..3}$) d) Temperature and Moisture ($X_{2..4}$)
3	The Government Role (X3)	a) Life Environment Legislation ($X_{3.1}$) b) Conservation Policy ($X_{3.2}$)
4	Bawean Deer Proliferation (Y1)	a) Artificial Insemination ($Y_{1.1}$) b) Ex-situ Conservation ($Y_{1.2}$) c) In-situ Conservation ($Y_{1.3}$)
5.	Bawean Deer Rescue (Y2)	a) Population Deployment ($Y_{2.1}$) b) Habitat Monitoring ($Y_{2.2}$) c) Deer Population Increase ($Y_{2.3}$)

III. Result And Discussion

General Description of Bawean Island in Indonesia

Bawean Island is a small island consisting of two districts. As said by Baginda A (2000), the island has estimately 19.204 hectares width. The location is on the realm of Java Sea between two big islands, Java Island and Kalimantan Island. It is 80 miles or 120 km from the north part of Gresik Regency. Administratively, since 1974, this island belongs to the region of Gresik Regency. In its genuine habitat, Bawean Deer is threatened to extinction. In the end of 2008, LIPI researchers mention that Bawean Deer population is left only to 400-600 heads. As reported by IUCN, such rare endemic animals are estimated remaining for 250-300 heads in its genuine habitat (2006). Because the population is very small and less than 250 adult species, IUCN Redlist since 2008 has assigned Bawean Deer into “Critical” category (CR = Critically Endangered) or “very susceptible to extinction threat”. CITES has categorized this species into “Appendix I”. The population of Bawean Deer (Axis kuhlii) becomes very rare and declining because the previously genuine habitat of Bawean Deer, precisely the natural forest, has been converted into teakwood forest with quite few bushes. It reduces food source for Bawean Deer. The declining of Bawean Deer population stimulates conservation efforts, among other is Bawean Island Animal Preserve extended to 3,831.6 Ha that is founded since 1979. Avoiding from extinction, thus, since 2000, Bawean Deer has been relocated into the captivity for further proliferation.

The Social-Economical Condition of Communities

Bawean Island communities are mostly working as farmers (62.23 %). Rice farming is widely managed by communities but the scale is still confined to household meals. The fulfillment of rice demand for island communities is still relying on the rice from Java Island. Other subsistence sectors are also indeed occupied by Bawean Island communities who live in the forest edge, such as being merchants (11.17%), fisher (5.85%), handicraft artisans (7.98%), and others 12.77% being the workers at service sector, Indonesia workers at abroad (TKI), and laborer.

Result of SEM Analysis Test

Table 2 Result of Linearity Assumption Test

Relation Between Variables		**Result of Testing**	**Decision**
The Condition Of Communities Around The Forest (X_1)	Bawean Deer Proliferation (Y_1)	All models have sig < 0.05 (linear model is significant)	Linear
The Natural Resource (X_2)	Bawean Deer Proliferation (Y_1)	All models have sig < 0.05 (linear model is significant)	Linear
The Government Role (X_3)	Bawean Deer Proliferation (Y_1)	All models have sig < 0.05 (linear model is significant)	Linear
Bawean Deer Proliferation (Y_1)	Bawean Deer Rescue (Y_2)	All models have sig < 0.05 (linear model is significant)	Linear

From the above table, it is known that all linear models are significant, and linearity assumption is satisfied. Thus, further analysis is conducted.

Measurement Model

Measurement model is measured from the *loading factor* (*standardize coefficient*) rates in every indicator to the latent variables. *Loading factor rate* reflects the weight of each indicator as the measurer of each variable. Indicator with biggest *loading factor* means that the indicator is the strongest (dominant) measurer for variable. Result of confirmatory factor analysis against indicators of three variables is shown in Table 3.

Table 3 Result of Testing *Measurement Model* Variables

Variables	Indicators	*Standardize*	*P-value*
The Condition Of Communities Around The Forest (X_1)	Education ($X_{1.1}$)	0.650	Fix
	Awareness ($X_{1.2}$)	0.715	0.000
	Perception ($X_{1.3}$)	0.679	0.003
	Attitude ($X_{1.4}$)	0.512	Fix
The Natural Resource (X_2)	Land Width ($X_{2.1}$)	0.452	0.001
	Grass Stock ($X_{2.2}$)	0.721	0.021
	Water Source ($X_{2.3}$)	0.563	0.010
	Temperature and Moisture ($X_{2.4}$)	0.474	Fix
The Government Role (X_3)	Life Environment Legislation ($X_{3.1}$)	0.712	Fix
	Conservation Policy ($X_{3.2}$)	0.783	0.000
Bawean Deer Proliferation (Y_1)	Artificial Insemination ($Y_{1.1}$)	0.801	Fix
	Ex-situ Conservation ($Y_{1\text{-}2}$)	0.702	0.016
	In-situ Conservation ($Y_{1.3}$)	0.649	0.023
Bawean Deer Rescue (Y_2)	Population Deployment ($Y_{2.1}$)	0.709	Fix
	Habitat Monitoring ($Y_{2.2}$)	0.794	0.000
	Deer Population Increase ($Y_{2.3}$)	0.735	0.000

Table 3 shows that *loading factor* rates of four indicators in the variable The Condition Of Communities Around The Forest (X_1) are arranged as follows: education ($X_{1.1}$) rated to 0.650 with *p-value* considered as fix; awareness ($X_{1.2}$) rated for 0.715 with *p-value* of 0.000; perception ($X_{1.3}$) rated to 0.679 with *p-value* of 0.003; and attitude ($X_{1.4}$) rated for 0.512 with *p-value* considered as fix. The significance of indicator can be understood from its *p-value*, which is if *p-value* is less than α(0.05), then indicator is significant. All *standardize* coefficients of indicators are significant and indicating obvious effect on the variable The Condition Of Communities Around The Forest (X_1). All coefficients are signed positive, and thus, the higher *standardize* coefficient is also the higher the result of measurement on the variable The Condition Of Communities Around The Forest (X_1). The highest SEM *Standardize* coefficient rate, as observed in Awareness ($X_{1.2}$), is the strongest indicator to be the measurer of The Condition Of Communities Around The Forest (X_1).

Loading factor rates of four indicators in variable The Natural Resource (X_2) are described as follows: Land Width ($X_{2.1}$) rated to 0.452 with *p-value* of 0.001; Grass Stock ($X_{2.2}$) rated for 0.721 with *p-value* of 0.021; Water Source ($X_{2.3}$) rated to 0.563 with *p-value* 0.010; and Temperature and Moisture ($X_{2.4}$) rated for 0.474 with *p-value* considered as fix. The significance of indicator is understood from its p-value, precisely if p-value is less than α(0.05), then indicator is significant. All standardize coefficients of indicators are significant and showing obvious effect on the variable The Natural Resource (X_2). All coefficients are positive, meaning that the higher *standardize* coefficient is also the higher the result of measurement on the variable The Natural Resource (X_2). The highest SEM *Standardize* coefficient rate, as found in Grass Stock ($X_{2.2}$), is the strongest indicator to be the measurer of The Natural Resource (X_2).

Loading factor rates of two indicators in variable The Government Role (X_3) are explained as follows: Life Environment Legislation ($X_{3.1}$) rated to 0.712 with *p-value* considered as fix and Conservation Policy ($X_{3.2}$) rated for 0.783 with *p-value* of 0.000. The significance of indicator can be understood from its *p-value*. If *p-value* is less than α(0.05), then indicator is significant. All *standardize* coefficients of indicators are significant with obvious effect on the variable The Government Role (X_3). All coefficients are signed as positive, and thus, the higher *standardize* coefficient is also the higher the result of measurement on the variable The Government Role (X_3). The highest SEM *Standardize* coefficient rate, as observed in Conservation Policy ($X_{3.2}$), is the strongest indicator to be the measurer of The Government Role (X_3).

Loading factor rates of tree indicators in variable Bawean Deer Proliferation (Y_1) are ordered as follows: Artificial Insemination ($Y_{1.1}$) rated to 0.801 with *p-value* considered as fix; Ex-situ Conservation ($Y_{1\text{-}2}$) rated for 0.702 with *p-value* of 0.016; and In-situ Conservation ($Y_{1.3}$) rated to 0.649 with *p-value* of 0.023. The significance of indicator is recognized from its p-value. If p-value is less than α(0.05), then indicator is significant. All *standardize* coefficients of indicators are significant which proves obvious effect on the variable Bawean Deer Proliferation (Y_1). All coefficients are signed positively, meaning that the higher *standardize* coefficient is also the higher the result of measurement on the variable Bawean Deer Proliferation (Y_1). The highest SEM *Standardize* coefficient rate, as found in Artificial Insemination ($Y_{1.1}$), is the strongest indicator to be the measurer of Bawean Deer Proliferation (Y_1).

Loading factor rates of three indicators in variable Bawean Deer Rescue (Y_2) can be elaborated as follows: Population Deployment ($Y_{2.1}$) rated to 0.709 with *p-value* considered as fix; Habitat Monitoring ($Y_{2.2}$) rated for 0.794 with *p-value* of 0.000; and Deer Population Increase ($Y_{2.3}$) rated to 0.735 with *p-value* of 0.000. The significance of indicator can be understood from its p-value, respectively if p-value is less than α(0.05), then indicator is significant. All *standardize* coefficients of indicators are significant and have an obvious effect on the variable Bawean Deer Rescue (Y_2). All coefficients are signed as positive, and thus, the higher *standardize* coefficient is also the higher the result of measurement on the variable Bawean Deer Proliferation (Y_2). The highest SEM *Standardize* coefficient rate, respectively shown by Habitat Monitoring ($Y_{2.2}$), is the strongest indicator to be the measurer of Bawean Deer Rescue (Y_2).

5.10.2. Analysis with Structural Equation Modeling

Structural Equation Modeling has four connective hypotheses (direct effect) from the influential variabels, such as The Condition Of Communities Around The Forest (X_1), The Natural Resource (X_2) and The Government Role (X_3) on Bawean Deer Proliferation (Y_1) and from Bawean Deer Proliferation (Y_1) on Bawean Deer Rescue (Y_2). The following is detail presentation of the testing result against the relationship of research variables, as shown in Table 5.19. Graphic view is indicated in Figure 1.

Table 4 The Direct Effect of Structural Equation Model

Relationship Between Variables	*Standardize*	*P-value*	Remarks
The Condition Of Communities Around The Forest (X_1) → Bawean Deer Proliferation (Y_1)	0,470	0,006	Significant
The Natural Resource (X_2) → Bawean Deer Proliferation (Y_1)	0,406	0,017	Significant
The Government Role (X_3) → Bawean Deer Proliferation (Y_1)	-0,109	0,544	Not Significant
Bawean Deer Proliferation (Y_1) → Bawean Deer Rescue (Y_2)	0,402	Fix	Significant

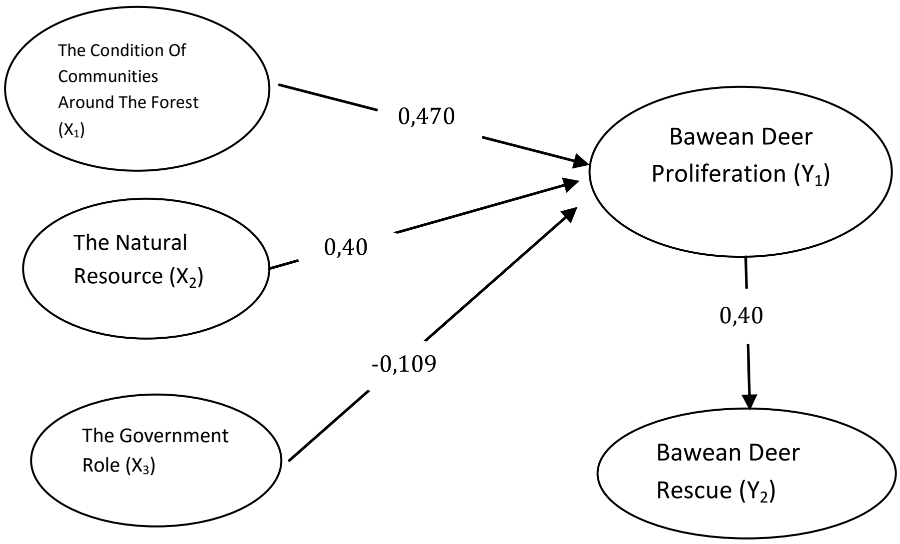

Figure 1 Comprehensive Relationship in Structural Equation Modeling

1. Testing of First Hypothesis

Based on the calculation result in AMOS, The Condition Of Communities Around The Forest (X_1) is significantly and positively influential to Bawean Deer Proliferation (Y_1). It is proved by positive signed path coefficient rated to 0.470. Significance probability (p) is 0.006. This value is smaller than significance level α(0.05). Therefore, the research hypothesis that The Condition Of Communities Around The Forest (X_1) is significantly influencing Bawean Deer Proliferation (Y_1) is verified. The rate of direct effect from The Condition Of Communities Around The Forest (X_1) on Bawean Deer Proliferation (Y_1) is 0.470, which means that every one increase of The Condition Of Communities Around The Forest (X_1) will increase Bawean Deer Proliferation (Y_1) for 0.470 units.

2. Testing of Second Hypothesis

As shown by the result of AMOS, The Natural Resource (X_2) is significantly and positively influential to Bawean Deer Proliferation (Y_1). It is proved by positively signed path coefficient rated for 0.406. The obtained significance probability (p) is 0.017. It is smaller than significance level α(0.05). Therefore, research hypothesis that The Natural Resource (X_2) is significantly influencing Bawean Deer Proliferation (Y_1) is confirmed. The rate of direct effect from The Natural Resource (X_2) on Bawean Deer Proliferation (Y_1) 0.406, meaning that every one increase of The Natural Resource (X_2) will increase Bawean Deer Proliferation (Y_1) for 0.406 units.

3. Testing of Third Hypothesis

Result of calculation in AMOS indicates that The Government Role (X_3) does not have significant effect on, but is negatively influential to, Bawean Deer Proliferation (Y_1). In Figure 5.10, influence path is colored red, which means that it is not significant. It is shown by negative sign rated for 0.109 and its significance probability (p) is 0.544. This value is bigger than significance level α(0.05). Thus, research hypothesis that The Government Role (X_3) is not significantly influential to Bawean Deer Proliferation (Y_1) is supported. The rate of direct effect from The Government Role (X_3) on Bawean Deer Proliferation (Y_1) is 0.109, which means that every one increase of The Government Role (X_3) shall reduce Bawean Deer Proliferation (Y_1) to 0.109 units.

4. Testing of Fourth Hypothesis

Pursuant to the calculation result in AMOS, Bawean Deer Proliferation (Y_1) is significantly and positively influential to Bawean Deer Rescue (Y_2). It is indicated by path coefficient signed as positive and rated to 0.402. The obtained significance probability (p) is considered as fix. Research hypothesis that Bawean Deer Proliferation (Y_1) is significantly influencing Bawean Deer Rescue (Y_2) is then verified. The rate of direct effect from Bawean Deer Proliferation (Y_1) on Bawean Deer Rescue (Y_2) is 0.402 meaning that every one increase in Bawean Deer Proliferation (Y_1) must increase Bawean Deer Rescue (Y_2) for 0.402 units.

Bawean Deer Proliferation (Y_1) is influenced significantly by two variables. The Condition Of Communities Around The Forest (X_1) is the variable with the biggest significant effect on Bawean Deer Proliferation (Y_1).

5.10.3. Goodness Of Fit

Theoretical model in research conceptual framework is then considered as *fit* because it is supported by empirical data. Result of testing on *goodness of fit for overall models* is compatible with the result of SEM analysis in Attachment 4 to understand whether hypothetic model is supported by empirical data. Detail is displayed on the following table.

Table 5 Result of Testing on *Goodness Of Fit for Overall Models*

Criteria	***Cut-of value***	**Model Result**	**Remarks**
Chi-square	Small	101.906	Not Good Model
p-value	≤ 0.05	0.003	Good Model
CMIN/DF	≤ 2.00	1.051	Good Model
GFI	≥ 0.90	0.907	Good Model
AGFI	≥ 0.90	0.869	Marginal
TLI	≥ 0.95	0.986	Good Model
CFI	≥ 0.95	1.000	Good Model
RMSEA	≤ 0.08	0.021	Good Model

The following is the model developed based on the result of SEM Analysis

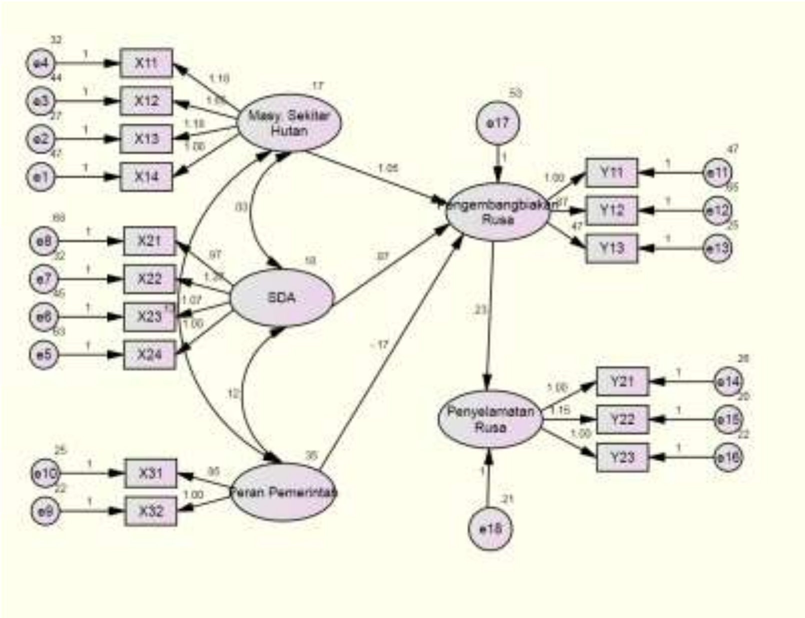

Figure 2 Path Diagram of the Result of SEM Analysis

Result of testing with *Goodness of Fit for Overall Models*, in conform to Table 5.17, has shown that one criterion of *Goodness of Fit* criteria that indicate not good model is *chi-square* because the rate is smaller than *cut off*. Six other criteria of *Goodness of Fit* , including *p-value*, CMIN/DF, GFI, RMSEA, CFI and TLI, have produced a model in good model category. The criterion AGFI shows marginal category because the rate approaches to the *cut off* limit. Solimun (2009) explains that in pursuance of Arbuckle and Wothke norms, there are two criteria which give the best indication for the goodness of the model. Both are CMIN/DF rated less than 2, and RMSEA rated below 0.08. In this research, CMIN/DF and RMSEA have met *cut off*. Therefore, SEM-based model in this research is suitable and feasible to be used.

IV. Conclusion

Based on the result and discussion previously stated, it is concluded that:

1. Bawean Deer proliferation is influenced by two factors, respectively the condition of communities around the forest and the natural resource. The government role is not quite influential to Bawean Deer proliferation.
2. Bawean Deer rescuing model is improving Bawean Deer proliferation sector by empowering communities around the forest and utilizing natural resource.

Suggestion

1. The government shall be more attentive to the efforts of Bawean Deer proliferation and rescue. It can be enforced through direct intervention to Bawean Deer habitat and direct monitoring to Bawean Deer rescue.
2. The communities may participate by improving sense of care for Bawean Deer rescue because communities are individuals with direct contact with Bawean Deer habitat. Communities must comply with government rules on protection for rare animals, including Bawean Deer.
3. Number of captivity location shall be increased, and proper method for Bawean Deer conservation must be identified.

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