

RESEARCH ARTICLE

BUFFALO BREEDING BUSINESS SYSTEM AND FEASIBILITY ANALYSIS IN RICE FIELDS PLATEAU OF NORTH KALIMANTAN.

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Abstract

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Buffalo is one of the livestock which adaptive in all kinds agroecosystem with high selling value, especially for religion's rituals. It is intereting to study, which is less studies and development program of buffaloes. The aim of this study is to identify buffalo breeding business system and feasibility analysis in rice fields plateau of north Kalimantan. This study done in 2017 at rice fields plateau agroecosystem of Krayan sub district, Nunukan district of North Kalimantan province. The methods of this study is quantitative research with cross sectional survey and purpossive random sampling for respondents determination. Primary and secondary data used for this study. Primary data were buffalo breeding business system datas from respondents, which collected used structured interviewed with questionaire. Secondary data were supporting datas from government service offices. Descriptive and inferential analysis used for this study. This result study show that buffalo farmers performance depend on areas accessibility and local agroecosystem, in terms of buffalo ownership, experiences in buffalo business, and farmer age. Buffalo reproductive performances in rice fields plateau agroecosystem of Krayan sub district, is in not good performances, in terms of birth mortality, calving rate, and sex ratio mating. Based on criterias and assumption, could be concluded that buffalo breeding business system in rice fields plateau agroecosystem of Kravan sub district, feasible to be done, eventhough on large scale. To increase buffalo performances in this area could be suggested to continously develop farmer's knowledge by non formal training and develop mating management by using elite buffaloes stud for nature mating system or artifficial insemination form other areas (outbreeding).

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..... **Introduction:-**

Krayan sub district, Nunukan district, North Kalimantan province is one of the rice fileds plateau agroecosytem with highest buffalo's population in North Kalimantan province, which 2.273 heads of 3.468 heads of total buffalo's population in North Kalimantan (BPS, 2017). In rice fileds plateau agroecosytem, buffalo have important role as part of rice field system which potentials as labor and fertilizer, and also have benefits as saving and meat provider.

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Buffalo breeding business system in rice fileds plateau agroecosytem still use extensive system from generation to generation. It mean, buffaloes pastured in rice field after harvest season and in pasture during planting season, with rice straw and graze as feed without any technologies innovation, and also use natural mating system for reproductive management which average 4 heads ownership for each farmer. This is generally condition of buffalo business system in Indonesia.

For many years, buffalo's population in North Kalimantan province have decrease, 4.287 heads (in 2013) become 3.214 heads (in 2016) (BPS, 2017), which mean 0,25% per year decrease of buffalo's population in North Kalimantan province. It is caused by highly birth and pre weaning mortality, because of limited pasture system have affect on nutritional adequacy, especially for buffaloes female. Beside that, highly demand unbalanced with supply of buffalo from birth. In other side, disruption of buffalo ecosystem with land clearing for palm oil plantation and coal mining, and also less technologies innovation for buffalo breeding system make it more difficult to buffalo development.

For that reasons, need great effort from all buffalo stakeholders to develop buffalo breeding business system, especially in Kalimantan. Buffalo breeding management development and upscale of buffaloes ownership with still use extensive system are strategic effort in order to buffalo development. Based on that, need study to be done in order to design buffalo breeding business system in rice fields plateau agroecosystem. So, the aim of this study is to identify buffalo breeding business system and feasibility analysis in rice fields plateau of north Kalimantan.

Research Methods:-

Research Location and Time:-

Research done in Krayan sub district which purpossive sampling method based on highest population of buffalo in North Kalimantan province. From this location determined intentionally in 3 villages were Pa'nado, Liang Tuer dan Long Bawan, at Krayan sub district, Nunukan district, as respondents based on highest buffalo's population of rice fileds plateau agroecosytem in North Kalimantan, with 3.287 heads or 94,56% of buffalo's total population in North Kalimantan. Beside that, the biological suitability with environmental carrying capacity in this area could make buffalo breeding business system become one of income source for rice field plateau farmers. This condition designed as integrated farming system in Adan rice field and buffaloes, that those harvest become export commodities to Malaysia and Brunei Darussalam. This study done in 2017.

Research Method:-

The methods of this study is quantitative research with cross sectional survey and purpossive random sampling for respondents determination. This research method designed as :

- 1. Observational research, based on data collected
- 2. Analitical research, based on data analyzed
- To respondents determination use formula :

$$n = \frac{N}{N(d)^2 + 1}$$

Information :

- n : total sampel
- N : total population
- d : 5% presition for galat population

Tabel 1:-Detail respondents in research location

No	Location	Total Farmer	Total Respondents
	Krayan Sub District		
1.	Long Bawan Village	26	21
2.	Liang Tuer Village	50	40
3.	Pa'nado Village	28	22
	Jumlah	104	83

Primary and secondary data used for this study. Primary data were buffalo breeding business system datas from respondents, which collected used structured interviewed with questionaire. Primary data collected from respondents about buffalo breeding business system and feasibility analysis done. There were :

- 1. Farmer characteristics : age, education level, ammount of family members at home, livelihood, experiences in buffalo business and farmer income
- 2. Buffalo breeding business system in : procedures, reproductive, housing and feeding
- 3. Buffalo feasibility analysis, such as : investment cost, production cost, population development and income value

Secondary data were supporting datas from government service offices. Secondary data were datas area, such as buffalo population, supply and demand of buffalo meat, buffalo slaughtering data, agricultural data, land use, organizational support and economic facilities. Secondary data collected from Government Development Planning Office, Statistical Bureau, Government Agricultural Service Office and Local Government Service Office.

Data Collection Method:-

Primary data collected by depth interviewed to respondents with questioners used and datas observed. Secondary data collected from government report and paper documents, previous research result and report, and also references study. Datas grouped according to needs and analyzed according to plan.

Data Analysis:-

Descriptive and inferential analysis used for this study, and also feasibility analysis. Descriptive analysis used to describe farmer characteristics and buffalo breeding management system. Inferential analysis use to concluded some events based on partial observation on events. Statistical inferential analysis devided into parametrical and non parametrical analysis. Feasibility analysis used with indicators : Net present value (NPV), Internal rate of return (IRR) dan Net benefit cost ratio (Net B/C ratio), and bufaalo marketing potential projection.

Research Result And Discussion:-

Characteristics of Respondents:-

Respondents in rice fields plateau characterized by age (year), educational level (year), experiences in buffalo business (year), family dependents (person), livelihood (%) and buffaloes ownership, which show in table 1.

No.	Characteristics of Respondents		In Location Total (%) 2 2.41 12 14.46 44 53.01 20 24.10 5 6.02 83 100	
		Total	(%)	
1.	Age			
	a. 20-30	2	2.41	
	b. 31-40	12	14.46	
	c. 41-50	44	53.01	
	d. 51-60	20	24.10	
	e. >60	5	6.02	
	Total	83	100	
2.	Educational Level (years)			
	a. Tidak sekolah (0)	11	13.25	
	b. SD (1-6)	21	25.30	
	c. SMP (7-9)	35	42.17	
	d. SMA (10-12)	13	15.66	
	e. D3/S1>12	3	3.61	
	Total	83	100	
3.	Experiences in Buffalo Business (years)			
	a. 1-10	3	3.61	
	b. 11-20	37	44.58	
	c. 21-30	33	39.76	
	d. >30	10	12.05	
	Total	83	100	
4.	Householde members (persons)			
	a. 1-2	37	44.58	
	b. 3-4	39	46.99	
	c. >4	7	8.43	
	Total	83	100	
5.	Main Livelihood (%)			

 Table 1:-Farmer responden's characteristic

	a. Farmer-Fisherman	52	62.65
	b. Businessmen	8	9.64
	c. Trader	0	0.00
	d. Carpenter	0	0.00
	e. Other (labour/government officer)	23	27.71
	Total	83	100
6.	Buffaloes ownership (heads)		
	a. 1-10	80	96.39
	b. 11-20	3	3.61
	c. >20	0	0.00
	Total	83	100

Source: primary data processed, 2017

Development potentials of buffalo breeding business system in rice field plateau agroecosystem is known from buffalo breeding management system used in group, and developed regularly along with intensively guiding and counseling from government agricultural services officer.

Age.

Table 1 show that mostly respondents in productive age group (30 - 50 years) 67,47% and rest of them in elderly group (over 50 years) with range 50 – 70 years. Average respondent's age is 46,89 years. This group choose buffalo breeding business as subsistein with main business in rice field production. This group always use their physical strength in order to run their business. All their business activities need physical strength, so age determine their physical strength and adoption level of innovation. Young farmers are minority in this rice field plateau agroecosystem, which age group of under 30 years only 2.41%. Dominant respondents age group between 41 and 50 years are 53,01%. This productive age group show that there are no problem in farmer's regeneration in this area and buffalo breeding business reliable and promising for their wealth in the future. This productive age group could be driven fast continously in order to develop their knowledge and abilities of buffalo breeding business by non formal training with intensively guiding and counseling

Educational level.

Educational level related to farmer's knowledge and abilities of buffalo breeding business. Educational level grouped into two, as formal education level and non formal education level. Based on table 1 show that respondent's formal education level in Junior High School wase the most dominant with 42,17%. It's mean that they have great potential in innovation adoption, as Turere research result (2013) stated that educational and training level affect farmer performances besides being influenced by other factors. Krasachat (2008) also stated that educated farmer more efficient in driven their business, because of their skill and better access to information and planning programs.

Experiences.

Respondents have many years experiences of buffalo business. They got knowledge and abilities of buffalo business from their families for generation to generation. Experiences is standard periods of farmer assignments. Table 1 show that respondent's experiences of buffalo business for 11 - 20 years was the most dominant with 44,58%. They have many years experiences of buffalo business because of buffalo's role. Buffalo's role are as : (1) family's income generating unit; (2) supporting unit for sustainable rice field farming system; and (3) preserved family business for generations. Many years experiences indicated well skilled farmer of buffalo breeding business system. The well skilled farmer has possibility to build vision and analyzed all of buffalo's breeding business opportunities and threats.

Household members.

Household members related to farmer living cost. Average respondent's household members were 3 - 4 persons (46,99%). Except the children, all of household members involved in buffalo breeding business system. Limited physical strength of household members and minimum level of innovation adoption, caused limitation of buffaloes ownership. More household members gave opportunities and threats for farmer performances and living cost. More household members gave bigger effort to driven their business in order to increase their income. But otherwise, more household members also gave threats in order to develop their business, because of limitation capital which

was usually use as income. More household members promising availability of labours, but otherwise give more pressure of farmer economic burden.

Main livelihood.

Respondent's main livelihood was farmer (62,65%). They are all have buffalo's business as subsistein livelihood, which traditionally managed and there were not much innovation adoption with highly agroecosystem dependency.

Buffaloes ownership.

The highest respondent's buffaloes ownership is group of 1 - 10 heads/farmer ownership (96,39%) or only 3,61% group of 11 - 20 heads/farmer ownership. Respondent's buffaloes ownership influenced by integrated farming system in Adan rice field and buffaloes done. It mean, buffaloes pastured in rice field after harvest season and in pasture during planting season, with rice straw and graze as feed without any technologies innovation, and also limitation of land use for pasture (0,5 - 1 hectare).

Integrated Farming System In Rice Field And Buffaloes:-

Farming system in rice field plateau of Krayan sub district done for generation to generation which agroecosystem dependency. Rice field was rotated depend on season and customary rules. Planting season for 6 months, which rice field planted once a year. Buffaloes pastured in rice field after harvest season (Pebruary to June). Buffalo's movement and activities caused graze and rice straw as harvest waste submerged and processed as fertilizer combined with their feces. During planting season, buffaloes herded in pasture on the edge of the forest and arround rice field with limitation of land use for pasture. These buffaloes business system have done for generation to generation as preserved family business for generations.



Figure 1:-Buffaloes Pastured Activities After Harvest Season

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Items	Informations			
- Agroecosystem	Rice Field Plateau			
- Total repondents	83 persons			
- Buffaloes ownership/farmer	1-10 heads			
- Length of business	generation to generation			
- Buffslo's system	pasture in rice field and limitation pasture land			
- Cage	extensive			
- Feed	forages and rice straw			
- Water resources	rainfed puddle			
- Business orientation	Buffalo's breeding business			

Table 2:-Characteristic of Buffalo Breeding Business System in Study Location

Source : primary data processed, 2017

Cage :-

Respondent's buffaloes did not grounded on the cage. They are released on rice field or pasture land. The pasture land on the edge of the forest and arround rice field highly fenced in order to prevent buffaloes get into rice field.



Buffalo's Reproductive Performances

Respondent's buffalo mating system use natural mating system with buffalo stud owned. Sex ratio mating is 1 buffalo stud : 2 buffaloes female. It was indicated that total of buffaloes stud was high. This condition affected mating competition between buffaloes stud and caused buffaloes stud scrambled. Buffaloes stud existences with no selection caused inbreeding and decrease productive and reproductive performances.

Repondent's buffalo's calving rate percentages was 70%. These percentages categorized as high in Indonesia based on Hardjosubroto result research (1984), show that buffalo's calving rate percentages was 54,69%. This condition suspected affect from highly sex ratio mating. Repondent's buffalo's calving intervals is 20 months and included in Guzman (1980) range that is 1 - 3 years or average 1,5 years (18 months).

Repondent's young buffaloes mortality was 15%. Based on observation, mostly buffaloes have body condition score = 2. It means that they have nutritional adequacy and causes young buffalo's mortality. Espcially for pregnant female which is birth in September until Nopember. They are mostly in nutritional adequacy condition which mean baby buffaloes in nutritional adequacy condition too, espcially for last trimester of pregnancy. This condition cause highly birth and pre weaning mortality. Pohan et al (2004) stated that in the last trimester of pregnancy (6 – 9 months), fetus ruminant in the fast growth phase, so they are need good nutrition in female feed. Based on observation, there are no forages with good nutrition planted in pasture and arround rice field. It caused overgrazing too, because of less carrying capacity of pasture.

Parameters			Informations
- Total buffalo's sample	309		
(heads)			
- First Estrus (years)		2.5	
- Calving intervals	20		
(months)			
- Calving rate (%)		70	
- Mortality (%)			15
- Buffaloes stud period	3.5		
(tears)			
- Sex Ratio Mating		1:2	
- Buffalo's Stud Source		inside population/outside	
		population	

Table 3:-Buffalo's Reproductive Performances in Rice Field Plateau Agroecosystem

Source : primary data processed, 2017

Buffalo's health:-

Respondent's buffaloes often in good health condition because of their area isolated from others. Disease caused by worms ever happened in 1 - 2 month of age which caused standing and dulled fur, and also decrease body weight. It

treatment used antiworms medicine. Another prevention treatment for buffaloes was vitamin injection by government agricultural service policies

Buffalo's selling:-

Respondent's buffaloes selling often done during Ramadhan month and closely Idul Adha. In those time total of buffaloes sold between 50 - 100 heads to other areas and country which is the location bordering with Malaysia and Brunei Darussalam. This sold mostly to meet Brumei Darussalam's demand. They are prefer to eat buffalo's meat from Krayan sub district because of it's quality. This suspected affected from natural buffalo's management system. The average respondent's buffalo's selling prices between Rp.9,6 millions – Rp.12,8 millions.

Buffalo's Breeding Business System Financial Analysis:-

Financial analysis indicators used based on condition of buffalo's breeding business system in respondent location. This financial analysis used to identify financial condition of buffalo's breeding business system in respondent location, especially for financial analysis and financial feasibility. For that, used financial assumptions and indicators based on condition of buffalo's breeding business system in respondent location.

No.	Technical Assumption	Unit	Total
1.	Business Period Projection	Years	20
2.	Business Scale (total female)	Heads	2
3.	Labour Cost	Rp/dow	100.000
4.	Selling Prices		
	a. Young male 3 years of age	Rp/head	9.000.000
	b. Young female 3 years of age	Rp/ head	7.000.000
	c. Rejected male	Rp/ head	13.500.000
	d. Rejected female	Rp/ head	11.500.000
	e. Younger male	Rp/ head	9.000.000
	f. Younger female	Rp/ head	7.000.000
5.	Exchange rate to Ringgit	Rp	3.500
6.	Younger mortality	%	15
7.	Interest rate	%	12

Table 4:-Parameter Used in Financial Analysis In Repondent Location

Source: primary data processed, 2017

Investment Cost dan Operational Cost

1. Investment Cost, show in table 5

Table 5:-Investment Cost of buffalo's breeding business system in respondent location

No	Items	Unit	Unit Costs	Total	Costs
			(Rp.000,-)		(Rp.000,-)
Busines	ss scale for 2 female				
1.	Livestock procurement				
а	Young females (3 years)	heads	7.000	2	14.000
b	Mating males (3 years)	heads	9.000	1	9.000
	Total of procurement cost				23.000
2.	Fence construction				
a	Barbed wire	m	7,5	1.499	14.000
b	Pole	m	10	136	1.355
с	Tenaga kerja	dow	100	27	2.700
	Total of fence construction cost				15.292
	Total Investment Costs				38.296

Source: primary data processed, 2017

Average investment cost of buffalo's breeding business system in respondent location are Rp.38.296.000,-/farmer, consist of procurement cost Rp.23.000.000,- and fence construction cost Rp.15.292.000,-. Operational Cost, based on extensive management there are no operational cost

Production and Income

Production and and income of buffalo breeding business system depend on total buffalo's sold buffalo's age and sex. Production and income projection of buffalo breeding business system describe in Table 6.

No	Year	Туре	Total	Selling Price	Value	Income Famer/year
				(Rp.000,-)	(Rp.000,-/year)	(Rp.000,-)
1	4	Young Female	1	7.000	7.00	0 16.000
		Young Male	1	9.000	9.00	0
2	5	Young Female	1	7.000	7.00	0 16.000
		Young Male	1	9.000	9.00	0
3	7	Young Female	1	7.000	7.00	0 16.000
		Young Male	1	9.000	9.00	0
4	9	Young Female	1	7.000	7.00	0 16.000
		Young Male	1	9.000	9.00	0
5	10	Young Female	1	7.000	7.00	0 16.000
		Young Male	1	9.000	9.00	0
6	12	Young Female	1	7.000	7.00	0 16.000
		Young Male	1	9.000	9.00	0
7	14	Rejected Female	1	11.500	11.50	0 25.000
		Rejected Male	1	13.500	13.50	0
8	15	Rejected Female	1	11.500	11.50	0 20.500
		Young Male	1	9.000	9.00	0
9	17	Young Female	1	7.000	7.00	0 16.000
		Young Male	1	9.000	9.00	0
10	19	Young Female	1	7.000	7.00	0 16.000
		Young Male	1	9.000	9.00	0
11	20	Female	2	11.500	23.00	0 46.000
		Male	1	13.500	13.50	0
		Younger Female	1	5.000	5.00	0
		Younger Male	1	5.000	5.00	0
	Total (Rp.000,-)					220.000
	Total (Rp.0	00,-/respondent)				11.000
	Total (Rp.0	00,-/respondent/year)				917

Table 6. Production	and income	projection	of huffalo	breeding	breeding	husiness system
Table 0:-Flouuction	and meome	projection	of bullato	breeding	breeding	Dusiness system

Source: primary data processed, 2017

Average respondent's buffaloes sold 2 heads/year, consist of 1 young female and 1 young male. Refers to the price at the time of study, average income were Rp.16.000.000,-/farmer/year. For 20 years, income projectioan are Rp.220.000.000,-/farmer or Rp.11.000.000,-/farmer/year or Rp.917.000,-/farmer/month.

Cash Flow

Cash flow for buffalo breeding business system, consist of cash inflow and cash outflow. Cash inflow from buffaloes total sold out started from fourth years with average of calving interval is 20,39 months.

This buffalo breeding business system is projected to give net profit Rp.181.704.000,- at 2 heads of mating females scale of business within 20 years. Assumed that buffaloes sold at 3 years ages with male and female ratio is 1 : 2. Cash flow in zero year to sixth years still negatives, because of high investment costs. Cash flow of buffalo breeding business system describe in Table 7.

Table 7:-Cash flow of buffalo breeding business system					
Tahun	Benefit	Investment	Cost	Total	

Tahun	Benefit	Investment	Cost	Total	Net Benefit	Cash Flow
	(Rp.000,-)	(Rp.000,-)	Production	Cost	(Rp.000,-)	(Rp.000,-)
			(Rp.000,-)	(Rp.000,-)	.+ (-)	.+ (-)
	1	2	3	4 = (2 + 3)	5 = (1 - 4)	6

0	-	38,296	0	38,296	(38,296)	(38,296)
1	-		-	-	-	(38,296)
2	-		-	-	-	(38,296)
3	-		-	-	-	(38,296)
4	16,000		-	-	16,000	(22,296)
5	16,000		-	-	16,000	(6,296)
6	-		-	-	-	(6,296)
7	16,000		-	-	16,000	9,704
8	-		-	-	-	9,704
9	16,000		-	-	16,000	25,704
10	16,000		-	-	16,000	41,704
11	-		-	-	-	41,704
12	16,000		-	-	16,000	57,704
13	-		-	-	-	57,704
14	25,000		-	-	25,000	82,704
15	20,500		-	-	20,500	103,204
16	-		-	-	-	103,204
17	16,000		-	-	16,000	119,204
18	-		-	-	-	119,204
19	16,000		-	-	16,000	135,204
20	46,500		-	-	46,500	181,704
Total	20,000	8,296	-	38,296	220,000	181,704

Source : primary data processed, 2017

Feasibility Analysis

Feasibility analysis used with indicators : Net present value (NPV), Internal rate of return (IRR) dan Net benefit cost ratio (Net B/C ratio), and buffalo business investment evaluation based on existence assumption.

Feasibility analysis indicators	Value
- NPV (Rp.000,-)	21.086
- IRR (%)	17,42
- Net Benefit Cost Ratio (%)	1,55

Source: primary data processed, 2017

Feasibility analysis indicators show that NPV Rp.21.086.000,- at discount factor 12% and IRR 17,42% also net benefit cost ratio 1,55. Based on those indicators and assumptions, show that theese buffaloes breeding business system is feasible.

Conclusions And Recommendations:-

Conclusions:-

Conclusions of this result are :

- 1. Buffalo breeding business system in rice fields plateau agroecosystem have highly potential based on reources, such as : natural, human, and socio-cultural, however area accessibility have low access and affect on limited technologies innovation applied in that area.
- 2. Buffalo reproductive performances in rice fields plateau agroecosystem of Krayan sub district, is in not good performances based on it's genetic potential, in terms of birth mortality, calving rate, and sex ratio mating.
- 3. Indicators of feasibility analysis showed that NPV Rp.21.086.000,- with discount factor 12%, IRR value 17,42%, and net benefit cost ratio 1,55%. Based on those indicators, concluded that buffalo breeding business system in Krayan sub district feasible to be done.

Recommendations:-

Recommendation from this research is need to develop the farmer's ability by trained them by non formal training in order to develop their ability in buffalo reproductive and productive management and also develop mating

management by using elite buffaloes stud for nature mating system or artifficial insemination form other areas (outbreeding).

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