



# The Exchange Rate Analysis of Catfish Cultivators: A Case Study in Sindangwangi Majalengka Indonesia

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## **Authors' contributions**

*This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.*

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## **ABSTRACT**

Majalengka Regency has great potential in the fisheries sector, because the availability of water in some areas is quite abundant even though it is in the dry season. This welfare of fish farmers can be seen using the Fish Farmer Exchange Rate Analysis (NTPI). I analyzed NTPI for catfish farmers in Majalengka Regency using a case study method, with sampling techniques, namely purposive sampling. Primary data was obtained from catfish farmers in Sindangwangi District, Majalengka Regency and secondary data were obtained from related agencies analyzed using NTPI. The results obtained in this study indicated that NTPI hatcheries catfish in Sindangwangi District have NTPI of 94%, which is NTPI<100 meaning that catfish hatchery cultivators are not yet at the prosperous level, while for NTPI catfish enlargement in Sindangwangi District had NTPI of 105% or NTPI>100 indicating that catfish enlargement cultivators have reached a prosperous level.

**Keywords:** Majalengka; NTPI; fish cultivator; catfish.

## **1. INTRODUCTION**

West Java is one of the provinces in Indonesia with the availability of abundant marine and land

fisheries resources (Center for KKP Data, Statistics, and Information 2018). The fisheries sector has the potential to drive the economy both at the macro, national and micro levels whereby

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Majalengka Regency in the country has great potential in the fisheries sector [1,2]. Based on data from the Food Security, Agriculture and Fisheries Service of Majalengka Regency (2020), the fishing area of Majalengka Regency consists of 554.62 Ha of calm water ponds, 121.20 Ha of rice fields, 178.95 Ha of lake, 231.65 Ha of swamp, checkdam 10.40 Ha, and river 513 Ha.

Freshwater fish production data in Majalengka Regency recorded total fishery production of 1,481.44 tons in 2015, 1,948.03 tons in 2016, and, 1,662.23 tons (2017), 1,427.38 tons (2018) and 1,458.38 tons, in 2019 making it included in the four residences that produce the highest fish production in West Java.

The welfare of fish cultivators in the Majalengka Regency was calculate through the Fish Cultivator Exchange Rate (NTPI). NTPI is the ratio between the price index received by fish farmers (It) and the price index paid by fish farmers (Ib), which is expressed in percentage terms.

The fisheries sector is considered vulnerable to poverty when most cultivators have small land or only work on land owned by others [3-6]. This paper is intending to report some findings on the research conducted to analyze the NTPI of catfish cultivators in the Majalengka Regency, especially in the Sindangwangi District.

## 2. METHODS

This research was carried out in Sindangwangi District, Majalengka Regency, West Java. We conducted the research using a case study methods with a questionnaire approach.

### 2.1 Types and Sources of Data

The study we conducted used both primary data and secondary data. Primary data obtained direct from the field through direct interviews with respondents using questionnaires. Secondary data were gathered from the available libraries and related sources such as libraries, the internet, and other general information.

### 2.2 Sampling Technique

The sampling We used purposive sampling technique, which involves certain considerations such as respondent involvement and respondents' willingness to be interviewed.

The respondents we considered met several criteria such as being:

- 1) Catfish cultivators.
- 2) Fish farmers who live in Sindangwangi District, Majalengka Regency.
- 3) Fish farmers with at least 5 years of work experience.
- 4) Fish farmers who are willing to be interviewed.

## 2.3 Data Analysis

A quantitative descriptive analysis was used to describe a phenomenon in a population. The NTPI formula is as follows.

$$NTPI = \frac{It}{Ib} \times 100\%$$

Whereas:

NTPI : Exchange Rate of Fish Farmers (%)

It : Price Index Received by Fish Farmers

Ib : Price Index Paid by Fish Farmers

NTPI of more than 100 means that fish farmers have higher incomes than their expenses, or have a surplus. NTPI of less than 100 means that fish farmers' expenses for household consumption and production costs are higher than their business income. While NTPI equals 100 means that the income of business results is equal to expenses for household consumption costs and production needs.

## 3. RESULTS AND DISCUSSION

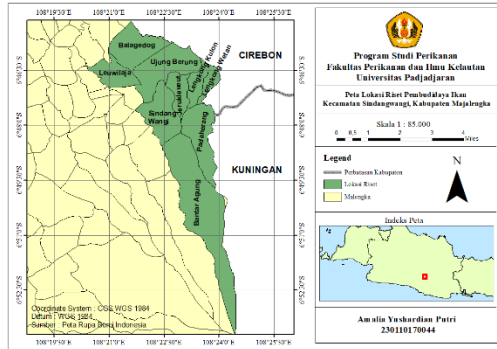
### 3.1 Characteristics of Research Locations

#### 3.1.1 Physical overview of the region

A map of Sindangwangi District is presented in Fig. 1. Sindangwangi District has a population of 32,576 people of which 16,250 are men and 16,326 women. The are has an average population density of 1,026 inhabitants / km<sup>2</sup>, with the highest density residing in Jerukleuet Village with a density of 1,919 people / km<sup>2</sup> and the lowest density located in Bantaragung Village with a density of 374 people / km<sup>2</sup> (BPS Majalengka 2020).

Sindangwangi subdistrict is located in hilly area just below the foot of Mount Ciremai. It has land and rice fields that elevating a height of 169 meters above sea level with a slope of land

between 15-40%. Sindangwangi District has regosol, grumosol, and latosol type of soil with soil properties of a pH of 6-7 or neutral (Sindangwangi District, 2020).



**Fig. 1. A map showing Research Location in Sindangwangi District**  
(Source: Rupa Bumi Indonesia Map)

**3.1.2 Overview of the fishery**

**a) Aquaculture Business Activities**

Freshwater fish farmers in Sindangwangi District are also involved in other business activities such as Calm Water Ponds, Heavy Water Ponds, rice *mina*, and lakes (Table 1).

**b) Aquaculture Production**

The superior commodities in Sindangwangi District are catfish, tilapia, and baung because of high production and have been developed quite well. (Majalengka Regency Food Security, Agriculture, and Fisheries Office, 2020). There are 137 fish farmers who belong to nine groups of fish farmers in Sindangwangi District.

**3.2 General Characteristics of Respondents**

**3.2.1 Age**

The age structure according to BPS (2013), is divided into three groups, namely (a) the young age group, under 15 years old; (b) productive age group, ages 15 - 64 years; and (c) the age group, age 65 years and above. A total of 44 respondents were in the age range of 15 - 64 years and 1 respondent was in the age range of >65 years (Table 1).

**3.2.2 Education**

The characteristics of respondents based on education level consist of elementary, junior high, high school and college levels (Table 2).

**3.2.3 Work Experience**

Characteristics of fish farmers in Sindangwangi District indicated to have work experience for 6-10 years as many as 35 people (78%), followed by work experience for 1-5 years as many as 6 people (13%), and work experience for >10 years with a percentage of 9% (Table 3). Work experience has a positive relationship with work productivity.

**3.2.4 Number of Family Members**

The characteristics of respondents based on the number of family members consisted of three groups, namely small family members (1-3 people), medium family members (4-6 people), and large family members (more than 6 people) [7]. The characteristics of respondents based on the number of family members can be seen in Table 4.

**Table 1. Respondent AGE RANGE DATA**

Respondent Age (Year)	Number (Person)	Percentage (%)
< 15	0	0
15-64	19	97
>65	1	3
<b>Total</b>	<b>20</b>	<b>100</b>

Source: Primary Data Processed (2021)

**Table 2. Respondent education level**

Education Level	Number (Person)	Percentage (%)
Elementary school	3	15
Junior high school	5	25
Senior high school	11	55
University	1	5
<b>Total</b>	<b>20</b>	<b>100</b>

Source: Primary Data Processed (2021)

**Table 3. Respondents' work experience**

Work Experience	Number (Person)	Percentage (%)
1-5 year	3	15
6-10 year	14	70
>10 year	3	15
<b>Total</b>	<b>20</b>	<b>100</b>

Source: Primary Data Processed (2021)

**Table 4. Respondent family member**

Number of Members	Number (Person)	Percentage (%)
Few (1-3 person)	9	45
Average (4-6 person)	11	55
Many (>6 person)	0	0
<b>Total</b>	20	100

Source: Primary Data Processed (2021)

### 3.3 Overview of Aquaculture Business in Sindangwangi District

There are two aquaculture business identified in this research namely catfish hatchery efforts and catfish enlargement efforts.

#### 3.3.1 Catfish hatchery business

Catfish hatchery business in Sindangwangi District is divided into two aspects, namely technical activity and economic activity.

##### A. Technical activity

Catfish hatchery efforts in Majalengka Regency, especially Sindangwangi District are mostly do with natural techniques, but there are also those who use semi-natural techniques with the help of hormones. Natural spawning (natural spawning) catfish is carried out in the ratio of 1:1 (female:male) that have mature gonads with relatively the same size of brood, then the fish spawn within one night. The colonized brood are picked up and separated into different containers to perform recovery. Eggs that have hatched are given feed in the form of a decoction of egg yolk for 1-2 days, then given silkworms as the main feed of seeds. Larval maintenance lasts for approximately 14 to 18 days until the majority of catfish fry reaches a size of 2-3 cm ready for sale.

##### B. Economical activity

The economic benefits of catfish seeding hatchery include investment costs, operational costs, and revenue.

###### a. Investment cost

Investment costs are the costs that its uses can last for a relatively long time (more than a year). Investment costs are usually related to the

construction or development of physical infrastructure and production capacity [8]. The investment cost of catfish hatchery business is presented in Table 5.

###### b. Operational cost

Operational costs are costs incurred or carried out while in the production process [8]. Operational costs in the hatchery business of catfish cultivation in Sindangwangi Subdistrict consist of two parts, namely fixed costs and non-fixed costs.

Fixed cost is the cost that is not consumable in use in one production period and costs that are not affected by the size of production [9]. The fixed costs of catfish farming business are employee and electricity costs.

Non-fixed costs (variable costs) are a number of costs used to produce fish and the amount depends largely on the amount of capacity and the period of production in question. These non-fixed costs change in number and the change is proportional to the unit of activity [3]. The non-fixed cost of the catfish farming business consists of feed, fertilizer / vitamin / medicine, and disinfectant.

The cost of producing catfish hatchery in Sindangwangi District can be seen in Table 6.

###### c. Revenue

It is the amount of money earned from the sale of a number of outputs or in other words any income earned by the proceeds from the sale of its production [10]. The cost of receiving catfish hatchery business is presented in Table 7.

#### 3.3.2 Catfish cultivation enlargement efforts

The effort to enlarge catfish cultivation in Sindangwangi District is divided into two aspects, namely technical activity, and economic activity.

##### A. Technical activity

Things that need to be considered in the technical aspect are the determination of location, production capacity, layout, selection of cultivation containers, production processes, use of fish feed, fish medicine, fertilizers, probiotics, disinfectants, other chemicals, and completeness of technical studies (Kep. Men KKP 2007).

Table 5. Investment cost of catfish hatchery cultivation business

No.	Land area (m2)	Description	Unit	Amount	Unit price (Rp/unit)	Total	Economic Life (yr)	Depreciation (Rp/yr)	Depreciation (Rp/cycle)	Proportion of Cost (%)
1	<1000	Ponds Construction	Unit	3	4.500.000	13.500.000	8	1.687.500	153.409	92
		Main	Unit	0	0	0	0	0	0	0
		Production Equipment	Unit	1	800.000	800.000	5	160.000	14.545	5
		Manufacture of feed and goods warehouses	Unit	1	300.000	300.000	1	300.000	27.273	2
		Production Support Equipment	Unit	1	300.000	300.000	1	300.000	27.273	2
		<b>Total</b>				<b>14.600.000</b>		<b>2.147.500</b>	<b>195.227</b>	<b>100</b>
2	1000 - 2000	Fish	pack	1	4.000.000	4.000.000	1	4.000.000	363.636	13
		Ponds Construction	unit	6	5.000.000	30.000.000	9	3.333.333	303.030	95
		Main	unit	0	0	0	0	0	0	0
		Production Equipment	unit	1	1.000.000	1.000.000	5	200.000	18.182	3
		Manufacture of feed and goods warehouses	unit	1	500.000	500.000	1	500.000	45.455	2
		<b>Total</b>				<b>31.500.000</b>		<b>4.033.333</b>	<b>366.667</b>	<b>100</b>
3	>2000	Fish	pack	1	4.000.000	4.000.000	1	4.000.000	363.636	10
		Ponds	unit	7	5.000.000	35.000.000	9	3.888.889	353.535	85

No.	Land area (m2)	Description	Unit	Amount	Unit price (Rp/unit)	Total	Economic Life (yr)	Depreciation (Rp/yr)	Depreciation (Rp/cycle)	Proportion of Cost (%)
		Construction Main Production Equipment	unit	0	0	0	0	0	0	0
		Manufacture of feed and goods warehouses	unit	1	2.000.000	2.000.000	5	400.000	36.364	5
		Production Support Equipment	unit	1	800.000	800.000	1	800.000	72.727	2
					<b>Total</b>	41.000.000		8.288.889	753.535	100

**Table 6. Catfish hatchery production cost**

No.	Land Area (m <sup>2</sup> )	Description	Total Cost (Rp)	Proportion of Cost (%)
1	<1000	Official	400.000	14
		Electricity	200.000	7
		Feed	2.000.000	69
		Fertilizer/vitamin/drug	300.000	10
		Disinfectant	-	-
	<b>Total</b>		2.900.000	100
2	1000-2000	Official	1.300.000	16
		Electricity	450.000	5
		Feed	6.000.000	73
		Fertilizer/vitamin/drug	500.000	6
		Disinfectant	-	-
	<b>Total</b>		8.250.000	100
3	>2000	Official	1.800.000	11
		Electricity	600.000	4
		Feed	14.000.000	82
		Fertilizer/vitamin/drug	600.000	4
		Disinfectant	200.000	1
	<b>Total</b>		17.000.000	100

Source: Primary Data Processed (2021)

**Table 7. Catfish hatchery business revenue**

No.	Land Area (m <sup>2</sup> )	Description	Total
1	<1000	Glass Selling Price (Rp)	13.000
		Annual Sales Results (Rp)	28.250.000
		Annual Net Earner (Rp)	26.830.000
		Monthly Clean Discharge (Rp)	2.235.833
		Annual production (glass)	2.173
2	1000-2000	Glass Selling Price (Rp)	13.000
		Annual Sales Results (Rp)	69.750.000
		Annual Net Earner (Rp)	65.250.000
		Monthly Clean Discharge (Rp)	5.437.500
		Annual production (glass)	5.365
3	>2000	Glass Selling Price (Rp)	13.000
		Annual Sales Results (Rp)	123.000.000
		Annual Net Earner (Rp)	113.250.000
		Monthly Clean Discharge (Rp)	9.437.500
		Annual production (glass)	9.462

Source: Primary Data Processed (2021)

## B. Economical activity

The economic sustainability of catfish farming includes investment costs, operational costs, and revenue.

- a. Investment costs are the costs that it uses that can last for a relatively long time (more than a year). Investment costs are usually related to the construction or development of physical infrastructure and production capacity [8]. The cost of investing in catfish

enlargement business is presented in Table 8.

### b. Production / Operational Costs

Production costs are costs incurred or carried out while in the production process [8]. Production costs in the hatchery business of catfish cultivation in Sindangwangi Subdistrict consist of two parts, namely fixed costs and non-fixed costs. The cost of producing catfish enlargement in Sindangwangi Subdistrict can be seen in Table 9.

**Table 8. Catfish enlargement business investment costs**

No.	Land Area (m <sup>2</sup> )	Description	Unit	Total	Unit Price (Rp/unit)	Total	Economic Age (yr)	Depreciation (Rp/th)	Depreciation (Rp/yr)	Proportion of Cost (%)	
1	<1000	Pool Construction	Unit	4	4.500.000	18.000.000	8	2.250.000	204.545	92	
		Main Production	Unit	1	350.000	350.000	1	350.000	31.818	2	
		Equipment									
		Manufacture of feed and goods warehouses	Unit	1	900.000	900.000	5	180.000	16.364	5	
		Production Support Equipment	unit	1	300.000	300.000	1	300.000	27.273	2	
		<b>Total</b>				19.550.000		3.080.000	280.000	100	
2	1000 - 2000	Fish	pack	1	4.000.000	4.000.000	1	4.000.000	363.636	13	
		Pool Construction	unit	6	5.000.000	30.000.000	9	3.333.333	303.030	94	
		Main Production	unit	1	400000	400.000	1	400.000	36.364	1	
		Equipment									
		Manufacture of feed and goods warehouses	unit	1	1.000.000	1.000.000	5	200.000	18.182	3	
		Production Support Equipment	unit	1	500.000	500.000	1	500.000	45.455	2	
		<b>Total</b>				31.900.000		4.433.333	403.030	100	
3	>2000	Fish	pack	1	4.000.000	4.000.000	1	4.000.000	363.636	9	
		Pool Construction	unit	8	5.000.000	40.000.000	9	4.444.444	404.040	86	
		Main Production	unit	1	450.000	450.000	1	450.000	40.909	1	
		Equipment									
		Manufacture of feed and goods warehouses	unit	1	2.000.000	2.000.000	5	400.000	36.364	4	
		Production Support Equipment	unit	1	500.000	500.000	1	500.000	45.455	1	
		<b>Total</b>				46.450.000		9.294.444	844.949	100	

Source: Primary Data Processed (2021)



**Table 9. Catfish enlargement production cost**

No.	Land Area (m <sup>2</sup> )	Description	Total Cost (Rp)	Proportion of Cost (%)
1	<1000	Official	450.000	16
		Electricity	200.000	7
		Feed	1.800.000	65
		Fertilizer/vitamin/drug	300.000	11
		Disinfectant	-	-
		<b>Total</b>	<b>2.750.000</b>	<b>100</b>
2	1000-2000	Official	1.000.000	13
		Electricity	450.000	6
		Feed	6.000.000	75
		Fertilizer/vitamin/drug	500.000	6
		Disinfectant	100.000	1
		<b>Total</b>	<b>7.950.000</b>	<b>100</b>
3	>2000	Official	1.700.000	10
		Electricity	600.000	4
		Feed	13.700.000	83
		Fertilizer/vitamin/drug	600.000	4
		Disinfectant	200.000	1
		<b>Total</b>	<b>16.600.000</b>	<b>100</b>

Source: Primary Data Processed (2021)

**Table 10. Catfish enlargement revenue**

No.	Land area (m <sup>2</sup> )	Description	Total
1	<1000	Selling Price (Rp)	18.000
		Annual Sales Results (Rp)	27.550.000
		Annual Net Earner (Rp)	26.350.000
		Monthly Clean Discharge (Rp)	2.195.833
		Annual production (kg)	1.531
		2	1000-2000
Annual Sales Results (Rp)	95.850.000		
Annual Net Earner (Rp)	88.530.000		
Monthly Clean Discharge (Rp)	7.377.500		
Annual production (kg)	5.325		
3	>2000		
		Annual Sales Results (Rp)	102.520.000
		Annual Net Earner (Rp)	95.640.000
		Monthly Clean Discharge (Rp)	7.970.000
		Annual production (kg)	5.696

Source: Primary Data Processed (2021)

### c. Revenue

Revenue is the amount of money earned from the sale of a certain amount of output or in other words any income earned by the proceeds from the sale of its production [10]. The cost of receiving catfish enlargement efforts is presented in Table 12.

### 3.4 Analysis of Fish Farmers Exchange Rate (NTPI) in Sindangwangi District

The Fish Farmer Exchange Rate (NTPI) is one of the proxies for measuring the level of welfare of

fish farmers. While definitively, NTPI is the ratio between the price received by fish farmers (It) and the price paid by fish farmers (Ib) expressed in percentage form [11].

#### 3.4.1 NTPI analysis of catfish hatchery

NTPI hatcheries catfish in Sindangwangi District can be seen in Table 11.

Based on the table above, NTPI from 7 catfish hatchery respondents in the Mina Lozi Makmur fish farming group in Sindangwangi District there

were 3 respondents (43%) who had NTPI >100, and 4 other respondents (57%) had NTPI <100. While in the Mina Cikole fish farmer group, out of 3 catfish hatchery respondents there were only 1 respondent (33%) who had NTPI >100 which can be said to be prosperous (NTPI of 104%).

Of the 10 catfish hatchery respondents in Sindangwangi District, there were 4 respondents (40%) who had NTPI >100 or could be said to be prosperous, while the other 6 respondents (60%) had NTPI <100 or could be attached to not be prosperous. The average NTPI hatchery of catfish in Sindangwangi District has NTPI of 94% or shows NTPI <100 which shows that respondents are less prosperous.

Research results Gumilar et al. [12,13] regarding Exchange Rate Analysis of Fish Cultivators in Bandung Regency has an NTPI > 100, this indicates that catfish hatcheries in Bandung Regency are more prosperous than fish hatcheries cultivators in Majalengka Regency. Meanwhile, according to BPS (2021), the national NTPI is 102.83% or NTPI > 100 which indicates that fish cultivators in Indonesia can be said to be prosperous.

### 3.4.2 NTPI analysis of catfish enlargement

NTPI catfish enlargement in Sindangwangi District can be seen in Table 12.

**Table 11. NTPI catfish hatchery**

No.	Group Name	Respondent's Name	Total Revenue (Rp/mo)	Production Expenditure / mo	Household Expenses / mo	Total Expenses / mo	NTPI (%)
1	Mina Lozi	Ade Sumarna	15.017.500	9.750.000	5.000.000	14.750.000	102
2	Makmur	Aman	6.437.500	4.500.000	2.300.000	6.800.000	95
3		Rohman					
4		Enah Roenah	5.273.333	4.720.000	1.800.000	6.520.000	81
5		Kosim	3.595.833	1.900.000	2.700.000	4.600.000	78
6		M. Sugiyana	3.594.167	1.050.000	1.600.000	2.650.000	136
7		Arta	3.735.833	1.420.000	2.000.000	3.420.000	109
8		Dede Taufiq	7.470.000	6.810.000	2.500.000	9.310.000	80
9	Mina Cikole	Amsi	6.045.833	3.700.000	2.100.000	5.800.000	104
10		Sutisna	3.037.500	1.050.000	2.800.000	3.850.000	79
		Udin	3.079.167	1.800.000	2.000.000	3.800.000	81
						<b>Average</b>	<b>94</b>

Source: Primary Data Processed (2021)

**Table 12. NTPI catfish enlargement**

No.	Group Name	Respondent's Name	Total Revenue (Rp/mo)	Production Expenditure / mo	Household Expenses / mo	Total Expenses / mo	NTPI (%)
1	Mekar	Agung	3.431.250	975.000	1.950.000	2.925.000	117
2	Wangi	Bayu Sapto	4.041.667	1.800.000	2.050.000	3.850.000	105
3		Pupu Saepudin	4.060.417	2.225.000	2.750.000	4.975.000	82
4		Suherman	7.310.000	4.480.000	2.800.000	7.280.000	100
5		Sobari	5.995.833	1.200.000	4.800.000	6.000.000	100
6	Mina Lozi	Nana	5.900.000	2.650.000	2.000.000	4.650.000	127
7	Makmur	Suparman					
8		Supriadi	10.377.500	7.320.000	3.100.000	10.420.000	100
9		Adok Karnadi	11.970.000	6.880.000	2.000.000	8.880.000	135
10	Mina Cikole	Ipung	6.229.167	2.100.000	5.000.000	7.100.000	88
		Wira	4.101.667	1.080.000	3.000.000	4.080.000	101
						<b>Average</b>	<b>105</b>

Source: Primary Data Processed (2021)

Based on the table above, NTPI catfish enlargement in Sindangwangi District from 5 respondents of mekar Wangi fish farming group there are 4 respondents (80%) who show NTPI >100 and 1 other respondent (20%) have NTPI <100, Mina Lozi Makmur fish farming group shows 3 respondents (100%) have NTPI >100, and Mina Cikole fish farming group there is 1 respondent (50%) who have NTPI <100, and 1 other respondent (50%) has NTPI >100.

Of the 10 catfish enlargement respondents in Sindangwangi District, there are 8 respondents (80%) who have NTPI >100 or can be said to be prosperous, while 2 other respondents (20%) have NTPI <100 or can be attached to have not prospered.

Research results Gumilar et al. [12,13] regarding the NTPI of catfish rearing in Bandung Regency has an NTPI>100, this result is the same as the results of research by Gumilar et al. [12,13] regarding the NTPI of catfish rearing in Garut Regency (Case Study in Bayongbong District) which showed an NTPI of 111% or NTPI > 100. This shows that catfish farmers in Bandung and Garut can be said to be as prosperous as catfish farmers in Majalengka Regency.

#### 4. CONCLUSION

Based on the findings of this research study on the Exchange Rate Analysis of Catfish Farmers in Sindangwangi District, Majalengka Regency, it is concluded that the Fish Farmer Exchange Rate (NTPI) for catfish hatcheries in Sindangwangi District had NTPI of 94 or NTPI<100, which means that catfish hatchery cultivators have not been at the prosperous level, as for the Exchange Rate of Fish Farmers (NTPI) catfish enlargement in Sindangwangi District have NTPI 105 or NTPI>100 meaning that catfish enlargement cultivators have reached the level of prosperity.

#### COMPETING INTERESTS

Authors have declared that no competing interests exist.

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