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RESEARCH ARTICLE

ANALYSIS ADAPTATION STRATEGIES FISH FARMERS FLOATING NET CAGES IN THE CIRATA RESERVOIRS

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ABSTRACT

This research was aim to analyzed floating-net fish farmers' adaptation strategy in reservoirs Cirata at Cianjur, West Java. The research was motivated by floating-net farmers' social economic condition experiencing public water resource quality degradation in Cirata reservoirs, from fish farming production process to fish products marketing. The research was done with survey method and simple random sampling. And it used SWOT (strengths, weaknesses, opportunities, and threats) analysis with quantitative description approach. With SWOT analysis, the result showed that floating-net fish farmers in Cirata reservoirs adaptation strategy is on second quadrant in facing threats, so they were advised to use the strengths to maximize long-term opportunities by diversifying fish farming, cooperating with input production owners (S2, S3, S4, S5, O1, O3, O4, O6), improvinh knowledge and skills in fish farming (S6, S7, O5, O1, O2, O6) and increasing floating-net fish farming productivity (S1, S2, S8, O2).

INTRODUCTION

Cirata reservoirs is one of artificial reservoirs located in weast Bandung district, Cianjur district, and Purwakarta with 6.200 hectare scope. This reservoirs was initially build as electricity power generator and other multiple purposes including fish breeding, farming, tourism, et cetera. Floating-net fish farming had a very significant growth, and out of Agency cirata reservoirs management control. Today the floating-nets reach around 52.000 units, while the advised capacity is 12.000 floating-net units (BPPU, 2012). This condition motivated the research about adaptation strategy of floating-net fish farmers in the Cirata reservoirs. The condition of public water in the Cirata reservoirs that was used for floating-net farmers' economy activities had a significant growth beyond the advised support. The floating-net farmers in the Cirata reservoirs were continually facing an environment and social economy changes. Environment condition was depending on climate change that was quite unpredictable and water quality that was tend to worsen, causing death and illness to the fish so the production amount was decreasing. Climate change was the main issue responded by many countries through seminars or conferences. Fish farmers, as manager in their businesses, have to be able to make the right decision to continue the floating-net fish farming. According to Baron (1994),

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"Decision-making is a kind of controlled thinking. It is a process of choosing among many possibilities which may be possible actions, beliefs and personal goals. While according to Dawes (1998), "Decision-making is a kind of thinking process aimed at making a judgement concerning a problem. There are two broad types of thinking, automatic and controlled. Automatic thinking is a kind of thinking that occurs when an individual responds to stimuli which have not been presented in the environment, being unaware of the thought process involved. Intuition is considered to be this kind of thinking. Controlled thinking is the thought process which is subjected to rigorous investigation through the consideration of all possibilities." Decision making in floating-net fish farming ranged from deciding the type of fish to breed, production input, to production output and marketing. Irzal Efendie, *et al.* (2005), "Based on the concept and practice of integrated farming of fish and livestock, the integration of intensive and semi-intensive aquaculture hasbeen developed in this reservoir and practiced for carp–Nile tilapia, tilapia–Nile tilapia, catfish–Nile tilapia and milkfish–Nile tilapia. This system reuses wastes derived from caged fish as a valuable resource for generating a natural food source for the culturing of filter-feeding species such as the Nile tilapia. Such a system allows the fish farmers to maximize fish production and profitability."

Production input supply, especially fodder's price fluctuation was not hand in hand with fish price, and unorganized social condition of the floating-net ownership caused social conflict

in society. Condition with high complexity demanded fish farmers' adaptation strategy to make the best decision in operating sustainable floating-net fish farming.

Adaptation applied for every living being that live in an environment that continuously changing. Bennet (1976) and Pandey (1993) regarded adaptation as human responsive behavior to environment changes. As a changing process, adaptation could result something predictable or unpredictable. Therefore, adaptation is an interaction system that always happens among humans, and between human and ecosystem. Hence, human behavior could change an environment or vice versa, changing environment needed new adaptation so humans could survive and live in their environment (Bennet 1976). Adaptation is part of the culture evolution process, which is a process that include a string of human efforts to adjust themselves or responding to physical or social environment changes that temporally occur (Mulyadi, 2007). Floating-net fish farmers in the Cirata reservoirs used adaptation strategy to keep their business.

MATERIALS AND METHODS

Public waters such as lake and reservoir are asset that can be used as food stability resource. The reservoirs fish farming production potential lend a big contribution to fresh water fish farming production, especially in West Java. The uncontrollably increasing amount of floating-nets has caused many problems with negative effects, both economically and ecologically for reservoir waters, for example the increasing amount of organic waste which caused mass fish death and worsen water quality.

Floating-net fish farming was facing a high business risk (high uncertainty) ranged from production input procurement, production process, and product marketing. Production input included (1) good-quality fish embryo with 90% life-expectancy from all breeds, (2) fish fodder in floating-net fish farming took 80% of production cost, fodder price tend to increase every month, so it affected production cost increase, (3) local workers with wholesale job system at harvest time needed a trust that put workers as main partner for business continuity, (4) resource quality in the Cirata reservoirs facing worsen water and environment quality caused by climate and weather changes that will affected floating-net fish farming productivity. Production input complexity faced by the fish farmers was manifested in floating-net fish farming decision making in the form of adaptation strategy to face changes that continually occur. The research was done in public waters of Cirata at Maleber village, sub district Mande, district Cianjur West Java, from July until October 2013. This research used primary and secondary data. Primary data was gain from interview with respondents using a questionnaire and direct observation. Primary data included basic condition of adaptation strategy done by floating-net fish farmers in public waters of lake Cirata at Cianjur district, West Java. Secondary data was achieved from government institutions, department of marine and fisheries West Java province, Research Institute for fisheries at Ciherang-Cianjur, and technical service unit department, including floating-net fish farming production statistic data and local regulation concerning floating-net fish farming. This research used survey methods while the data-collecting used direct interview technique to respondents with a questionnaire guide. Sampling was done with simple random sampling technique to 45 floating-net fish farmer respondents in public waters of Cirata reservoir in Kabupaten Cianjur, West Java.

Data Analysis Methods

The data was analyzed quantitatively to explain floating-net fish farmers' adaptation strategy in the Cirata reservoirs public waters at district Cianjur, West Java. The research used SWOT analysis. SWOT analysis is an instrument used to analyze floating-net fish farmers' adaptation strategy in the Cirata reservoirs . Panagiotou, 2003; Ghazinoorya, 2011, "The SWOT (strengths, weaknesses, opportunities and threats) analysis is used more than any other management technique in the process of decision making. It was developed between the 1950s and the 1960s as a major advance in strategic thinking. The SWOT analysis focuses on the analysis of an organisation's internal and external environment with the aim of identifying internal strengths in order to take advantage of its external opportunities and avoid external threats, while addressing the organisation's weaknesses. Deciding the best strategy was done with scoring every SWOT factors (strengths, weaknesses, opportunities, and threats) based on influence level and area condition. The score given was from 1-4. 1 means not influential, 2 means rather influential, 3 means quite influential and 4 means very influential. After each SWOT factors (strengths, weaknesses, opportunities, and threats) was scored, those factors were connected to achieve several alternative strategy, S-O (strengths-opportunities), S-T (strengths-threats), W-O (weakness-opportunities), W-T (weaknesses-threats). Then, those alternative strategies' score were summed up to get ranks from each alternative strategy. Strategy with highest rank considered as the main priority.

SWOT (strengths, weaknesses, opportunities, and threats) matrix is a matrix that integrating internal and external strategic factors. This matrix can clearly describe how opportunities and threats (external) that we faced can be adjusted with strength and weakness that we have (Freddy Rangkuti, 2001: 31).

RESULTS

From interview with floating-net fish farmer respondents at at Maleber Village district Cianjur, West Java, it was known that they used adaptation strategy based on knowledge, experience, and fish farming education, both formal and informal. Floating-net fish farmers' education level in the Cirata reservoirs public waters is 45% of them were junior high school graduates, and the average experience to be a fish farmer was above 10 years. This condition became a fish farmer's basic strategy to do his business. Fish farmer's adaptation strategy was analyzed using SWOT (strengths, weaknesses, opportunities, and threats) analysis. The floating-net fish farmers' strengths are diversifying fish farming type, cooperating with production input owners, warehouse system for fish fodder, public irrigation system (open user), local workers supply, knowledge about floating-net fish farming,

experience in floating-net fish farming, maximizing public waters resources, can be seen on Table 1 below:

Table 1. IFAS (Internal Factor Analysis Summary)/Strengths

No	Internal Factor	Value	Rating	Score
1.	Diversifying fish farming	0.15	4	0.60
2.	Cooperating with production input owner	0.12	4	0.48
3.	Warehouse system for fish fodder	0.25	4	1.00
4.	Open user public irrigation system	0.10	3	0.30
5.	Local worker supply	0.10	3	0.30
6.	Knowledge on floating-net fish farming	0.08	3	0.24
7.	Experience onfloating-net fish farming	0.10	4	0.40
8.	Maximizing public waters resources	0.10	2	0.20
	Total	1.00	3.52	

Warehouse system for fish fodder got the biggest value 0.25 as fodder production input hold important role in fish farming, the increase of fodder price to about Rp. 6,000,00 to Rp. 7,500,00/kg burdened the fish farmer to run their business. Floating-net fish farmers' adaptation strategy was by diversifying fish farming, from *ikan mas* to other fish like tilapia goldfish, pomfret, catfish., pomfret was chosen because this fish doesn't need high-protein fodder, so the farmers can reduce production cost for fodder. Fish farmers' adaptation strategy in the Cirata reservoirs done through fodder warehouse system, this was done to fulfill fodder production input demand as many as 1.000 tons per month for public waters in the lake Cirata reservoir. The warehouse system was done by using the fodder first and pays later after harvest. Warehouse system adaptation strategy helped fish farmers with limited capital in supplying production input (Nurhayati, 2012). Fish farming adaptation strategy through fish farming diversification was done by choosing economically more profitable fish farming commodity and environmentally-friendly for Cirata reservoirs public waters. Not only goldfish, several other kind of fish were bred by the farmers, today they turn to other commodity such as tilapia, koi, catfish, pomfret. From interview with respondents, pomfret was proofed to have market prospect with high demand from Jakarta, Semarang, dan Surabaya, and also from neighboring area in the Cirata reservoirs. Today, pomfret farmers price is around Rp. 7,000,00 – 7,500,00/kg., pomfret breeding period is shorter than goldfish, 45-60 days whereas goldfish needed 3-4 months to harvest.

Floating-net fish farmers in Cirata reservoir's public waters had internal weaknesses such as fish farming permit, high amount fodder demand, floating-net fish farming activity brought high pile of fodder's leftover, low quality fish embryo, production number that tend to decrease, limited capital, and environmentally unfriendly technology, can be seen on Table 2. Fish farming business permit in the Cirata reservoirs is very ironic, considering the floating-net condition was already overcapacity. Floating-net fish farming permit was difficult to be implemented to the farmers.

High amount fodder use made fish farmers took decision making adaptation strategy to breed , pomfret . Because of cheap fodder price, the farmers only have to use fodder with 25% protein. It was much lower than the protein in fodder for goldfish, that usually reach 27%.

Table 2. IFAS (Internal Factor Analysis Summary)/Weaknesses

No.	Internal Factor	Value	Rating	Score
1.	Floating-net fish farming permit	0.10	2	0.20
2.	High amount fodder	0.25	4	1.00
3.	Fodder's leftover	0.13	2	0.36
4.	Low quality embryo	0.08	3	0.24
5.	Decreasing production number	0.12	4	0.48
6.	Limited capital	0.06	2	0.12
7.	Environmentally unfriendly technology	0.10	3	0.30
8.	Low farmers institution dynamics	0.07	1	0.07
9.	Low production number continuity	0.10	3	0.30
Total		1.00	3.07	

Floating-net fish farming growth in the Cirata reservoirs is intensively increasing, which means the more fish the they bred the more organic waste (fish droppings and fodder leftover) that will stimulate the waters' productivity and affected the waters' biotic and non-biotic characteristics (Krismono, 1992). Opportunities factor in floating-net fish farming are fish demand level from Jabodetabek area, fish farming product diversification, accessibility to potential market, capital aid from formal monetary institution, people's knowledge about fish's nutrition value, fish farmers' training from the government, can be seen in Table 3 below:

Table 3. EFAS (External Factor Analysis ummary)/Opportunities

No.	External Factor	Value	Rating	Score
1.	Fish demand from Jabodetabek area	0.30	4	1.20
2.	Fish farming products diversification	0.25	4	1.00
3.	Accessibility to potential markets	0.15	4	0.60
4.	Capital aid from monetary institution	0.10	3	0.30
5.	People's nutrition knowledge	0.10	3	0.30
6.	Fish farmers training	0.10	3	0.30
	Total	1,00	370	

Fish production from Cirata was not only consumed at Cianjur. The market reached Jakarta, Banten, Lampung, Sumsel, Central Java, East Java, East Kalimantan, and Papua, with Jakarta being the biggest market. Cirata's fish was sold both freshly alive and processed products. Tilapia and prompt was marketed freshly dead, while *ikan mas* both freshly dead or alive (packed in oxygenated plastic bags). Goldfish ' price is around Rp. 12,000 – Rp. 15,000 / kg. Threats factor for fish farmers in the lake Cirata reservoir's public waters are fluctuated fodder price increase, worsen waters quality, mass fish death, climate changes, unstable harvested-fish price, fish herpes disease growth, low quality floating-net fish, can be seen on Table 4 below:

Table 4. External Factors Analysis Summary/Threats

No.	External Factor	Value	Rating	Score
1.	Fluctuated fodder price increase	0.30	4	1.20
2.	Worsen water quality	0.12	3	0.36
3.	Mass fish death	0.10	3	0.30
4.	Climate changes	0.13	3	0.39
5.	Unstable harvested-fish price	0.15	3	0.45
6.	Fish herpes disease growth	0.12	3	0.36
7.	Low quality floating-net fish	0.08	2	0.16
Total		1,00	3.22	

Fodder price fluctuation was not hand in hand with harvested-fish price. Climate changes such as rainy season to dry season

made fish farmers in Cirata reservoirs decrease embryo planting from one quintal to 50 kg to prevent big loss. Floating-net fish farmers' adaptation strategy to be prepared to face turn over and virus attack was done by harvesting earlier. Several disease use to attack the fish during dry season, for example herpes that attack caprianus carpio (Nurhayati, 2012). IFAS (Internal Factor Analysis Summary) and EFAS (External Factor Analysis Summary) matrix was used to determine that floating-net fish farmers' position in Cirata reservoirs public waters was at second quadrant where the farmers faced threats in running fish farming production process. Despite the threats, fish farmers in the lake Cirata still have internal strengths. The best strategy is to use those strengths to maximize long-term opportunities by diversifying fish types to breed.

Floating-net fish farmers' in Cirata reservoirs public waters' adaptation strategy need fish farming management and arrangement through fisheries business licenses, fish business permit, socializing and implementing compatible fodder, using environmentally friendly floating-net fish farming technology, continual floating-net fish farming management, improving supply chain, fish products' safety warranty to consume, strengthen the floating-net fish farmer organizations.

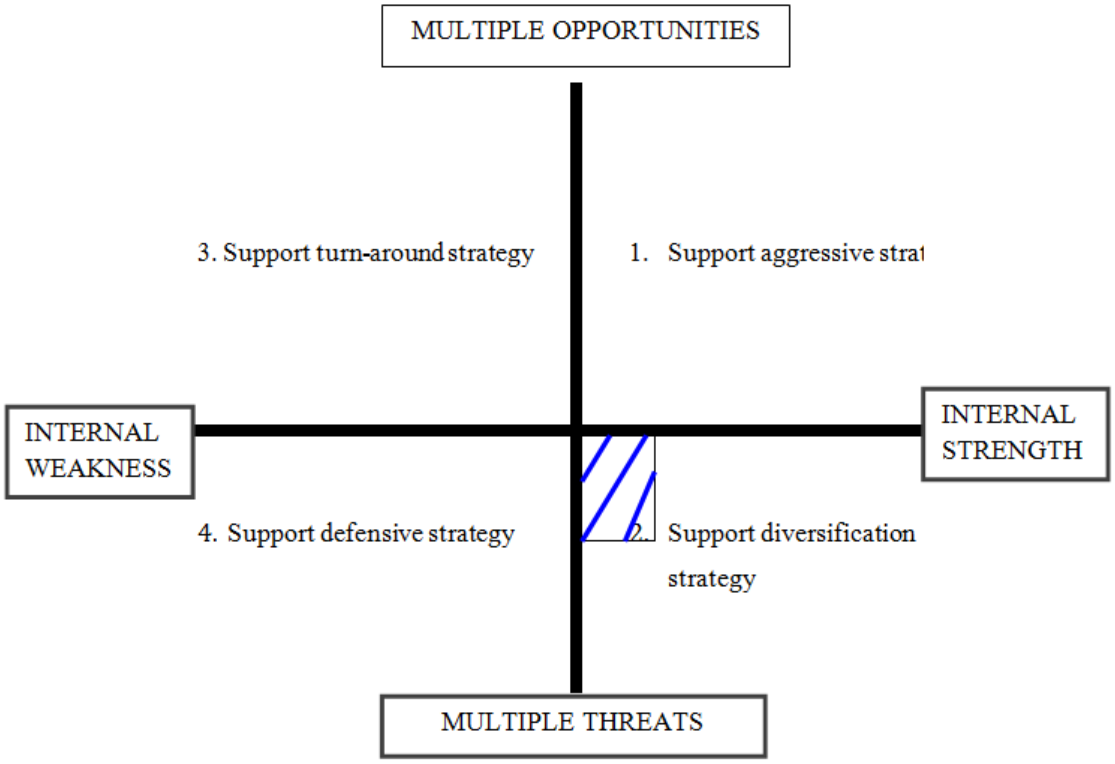

Fig. 1. SWOT Analysis

Table 5. Floating-net fish farmers in the lake Cirata public water's adaptation strategy

S – O Strategy (Strengths – Opportunities)	W – O Strategy (Weaknesses - Opportunities)
Cooperate with production input owners (S2, S3, S4, S5, O1, O3, O4, O6)	Arranging the floating-net fish farming (W1, W3, W7, W8, O6)
Improve their knowledge and skills in fish farming (S6, S7, O5, O1, O2, O6)	Socializing and implementing compatible fodder (W2, W3, W6, W8, W9, O4, O6)
Increase floating-net fish farming productivity (S1, S2, S8, O2)	Using environmentally friendly floating-net fish farming technology (W3, W4, W5, W7, O3, O6)
S – T Strategy (Strengths – Threats)	W – T Strategy (Weaknesses – Threats)
Alternative fodder (S2, S3, S6, T1)	Continual floating-net fish farming management (W1, W7, W8, W9, T1, T2, T3, T4, T5, T6, T7)
Optimizing Cirata reservoir's public waters management (S1, S2, S4,S8, T2, T3, T4)	Improving supply chain (W5, W9, T5, T7)
Fish products' safety warranty to consume (S1, S6, S7, T3, T6, T7)	Strengthen the floating-net fish farmer organizations (W1, W8, T1, T5)

The best adaptation strategies for floating-net fish farmers in Cirata reservoirs public waters are to cooperate with production input owners, improve their knowledge and skills in fish farming, and increase floating-net fish farming productivity, can be seen on Table 5 below:

Conclusion

Using SWOT analysis, floating-net fish farmers' in Cirata reservoir's public waters are on second quadrant in facing threats, so the advised adaptation strategy for the farmers are

using the strengths to maximize long-term opportunities by diversifying fish farming, cooperating with production input owners, improving knowledge and skills in fish farming, and increasing floating-net fish farming productivity.

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