

## Co-Management Models in Small Scale Shrimp Fisheries Management in Cilacap Regency, Central Java Province

Drama Panca Putra<sup>1\*</sup> Mulyono S. Baskoro<sup>1</sup> Eko Sri Wiyono<sup>1</sup> Sugeng Hari Wisudo<sup>1</sup> Wudianto<sup>2</sup>

1.Department of Modeling Systems of Fisheries, Post Graduate School, Bogor Agricultural University  
PO. BOX 16680, Darmaga, Bogor West Java, Indonesia

2.Research Center for Fisheries Management and Conservation (RCFMC) Ministry of Marine Affairs and Fisheries, PO.BOX 14440, North Jakarta, Jakarta, Indonesia

\* E-mail of the corresponding author: dramapp@gmail.com

### Abstract

Cilacap regency, Central Java Province of Republic of Indonesia, contributes the highest marine fish production in Central Java, which is about 7,616 tons (88.84%), where the shrimp fishery is the main contributor in addition to tuna, skipjack and like tuna (DMF Central Java, 2013). The concept of co-management is considered relevant to drive the role of stakeholders in order to support the management of the shrimp fishery. The purpose of the study is to identify the internal-external factors shrimp fishery, analyzing the components of the establishment co-management and co-management models determine appropriate and sustainable in the management of small-scale shrimp fisheries. Internal factors which influence is important in the management of small-scale shrimp fisheries are catching skills, participation of fishermen, the amount of the catch and the ability of capitalization, while the external factor is the support of the relevant agencies, the significant role of the private sector, illegal logging and land conversion, and space utilization conflict. Components becomes an important criterion in the establishment of the co-management of small-scale shrimp fisheries is the socio-economic conditions of fishermen (RoI = 0.347; IR = 0.02), whereas the limiting component is a condition of the resource and fishery infrastructure conditions. Model appropriate co-management in small-scale shrimp fisheries management in the Cilacap regency is a co-management cooperative (RoI = 0.259; IR = 0.002).

**Keywords:** co-management, small-scale fisheries, stakeholders, shrimp

### I. Introduction

#### 1.1 Background

As mandated by the Law No. 32 of 2004 on Regional Government, the state authorized the Provincial Government to manage the region the sea 12 miles from the nearest coastline or islands, and the Government of Regency as far as third province. The authority may include exploration, utilization, conservation, spatial arrangements, law enforcement, the implementation of the central authority affluent, aid the enforcement of security and sovereignty. However, implementation of these powers in the fisheries sector tends to make Local Government too dominant and often rule out the involvement of small-scale fishing communities in particular as a target. In Cilacap regency, for example, the government began to act as executor of the planning, implementation and supervision, while the community of users (user groups) such as fishermen and private only receive information about the products of government policy.

Currently Cilacap regency contributes the highest marine fish production in Central Java province, reaching 7.616 tons (88,84%) with which the shrimp into the main product besides tuna, skipjack and like tuna (DMF Central Java, 2013). Given the magnitude of these contributions, the management of fisheries, especially shrimp fishery in Cilacap regency needs to be organized well through the concepts of management that actively involves the public in a variety of management actions, so that the contribution of shrimp fishing in Cilacap regency, which mostly comes from the kind of shrimp jerbung (*Penaeus merguensis*), grosok shrimp, and dogol shrimp (*Metapenaeus ensis* and *Metapenaeus endeavouri*) can be maintained. The concept of co-management is considered relevant to mobilize relevant stakeholders, especially the role of the community in order to support the management of the shrimp fishery.

Pomeroy and Williams (1994) explains that the concept of co-management is a management concept that is able to accommodate the interests of the community. In other words, co-management is defined as the division of responsibilities and powers between the government and the public, especially fishermen and private sector related to the management of local natural resources such as fisheries, coral reefs, mangroves, and so forth. In the concept of co-management, shrimp fishing is an important partner together with government and other stakeholders in the management of shrimp resources in the waters of Cilacap regency.

However, the implementation of co-management is highly dependent on the internal-external condition of the shrimp fishery management is conducted primarily small fishermen, the various components that affect the establishment of co-management is on site, as well as the type of co-management are applied, thus ensuring the principles of shrimp fisheries co-management is performing well. Makino, *et. al* (2009) and Dahuri, *et. al* (2001) stated that the main principle of co-management that should be emphasized is (1) a complete application

from the planning, implementation of strategic games, to monitoring, (2) all stakeholders (stakeholders) are given the opportunity to be actively involved in the management, (3) management framework not only for the purpose of ecological conservation, but also includes economic goals, socio-cultural, and institutional. This study will try to assess the co-management models are appropriate for small-scale shrimp fisheries management in the Cilacap regency, Central Java.

### *1.2. Research Objectives*

This study aims to:

- 1) Identify the internal-external factors management of small-scale shrimp fisheries.
- 2) Analyze the components that affect the establishment co-management.
- 3) Determine the co-management model of appropriate and sustainable that can be used in the management of small-scale shrimp fisheries

## **2. Methods**

### *2.1 Time and Place Research*

This research has been conducted in the waters of Cilacap regency, Central Java Province in July to December, 2013.

### *2.2 Type of Data Collected*

The data collected in this study consisted of primary data and secondary data. In general, the type of data collected from both primary and secondary data are:

- 1) Data internal conditions (strengths and weaknesses) and external conditions (opportunities and threats) in the management of small-scale shrimp fisheries.
- 2) Data of various components that affect the formation of the co-management of small-scale shrimp fisheries either in the form of management criteria that must be achieved and that the limiting (limit factor) in the formation of co-management.
- 3) The data relating to co-management options offered to the co-management instruction, co-management consultative, co-management cooperative, co-management advisory, and co-management informative.
- 4) Data legislation related

### *2.3 Data Collection Method*

The primary data collection method consists of the selection of the sampling group, the identification of the respondent, and respondent data collection. Sampling groups are stakeholders associated with shrimp fisheries activities in Cilacap regency, Central Java, which is representative of the shrimp fishermen, processors / traders shrimp products, private, fishing port management, Department of Marine, Fisheries and Resource Management of Segara Anakan Regions (DMFRSRSA), and community coast. Factors considered in the selection of this sampling group are: population sampling group. level of involvement in the activities of the shrimp fishery, and direct interactions with fishing shrimp sampling group.

The respondents have been selected by purposive sampling from sampling groups based on personal, knowledge, and mastery of group activity. The provisions of the respondents are:

- 1) The number of respondents for data collection SWOT analysis about 5-10% of the population of small-scale shrimp fishermen in Cilacap regency, Central Java.
- 2) The number of respondents for data collection co-management of small-scale shrimp fisheries refers to the provision of AHP by Saaty (1991), which is about 20 people. Respondents came from a couple of figures from a representative sampling of all groups.

The data collection respondents conducted by the two techniques, namely the open interview techniques and contingent value method (CVM). Open interview techniques conducted to collect the data of small-scale shrimp fisheries management that requires information from the offender directly or indirectly in the location. CVM conducted to collect data on the co-management model of the shrimp fishery. CVM is done by creating a hypothetical market conditions, so that the respondents seemed to feel what is illustrated enumerators, and then the respondents can answer with either what was asked.

Secondary data collection method consisted of a literature review and an expert opinion. The study of literature is used to collect secondary data derived from activity reports, books, legislation, and related journals shrimp fisheries co-management. Expert opinion is an opinion or idea presented by researchers, academics, and practitioners fisheries through mass media and electronic-related co-management of fisheries and fisheries management in general.

## 2.4 Data analysis

### 2.4.1 SWOT Analysis

SWOT analysis is used to analyze the internal and external factors that influence essential in the management of small-scale shrimp fisheries in Cilacap regency, Central Java. The stages of analysis were carried out with reference to Rangkuti (2006) are: (1) Preparation of matrix IFAS, an activity determines both internal factors such as strengths and weaknesses in the management of small-scale shrimp fisheries, complete with analysis results weighting, rating and score. (2) Preparation of EFAS matrix, is a determining factor activity in the form of external opportunities and threats in the management of small-scale shrimp fisheries, complete with analysis results weighting, rating and score. In this analysis, weight rated 0-1, where 0 indicates no importance and 1 indicates very important. While rating rated 1-4, where 1, 2, 3, and 4 states respectively low, normal, high, and very high. Rating values for the factors given the weaknesses and threats in reverse. While the score is the multiplication with the weight rating.

### 2.4.2 AHP Analysis

Analytic Hierarchy Process (AHP) is used to analyze the components that affect the establishment of co-management and co-management models determine the proper and sustainable that can be used in the management of small-scale shrimp fisheries. For this purpose, then, the consideration of all the criteria required by the management, the limiting component (limit factor), the options offered by the co-management becomes an important input in the AHP analysis. Stages of analysis developed in this AHP analysis refers to Mustaruddin *et. al* (2011) and Saaty (1991), the identification system, hierarchical structuring, simulation, and statistical tests. The identification system is intended to assess and determine the components / criteria as well as co-management options that the scope of small-scale shrimp fisheries management based co-management. Preparation of hierarchical structures is an activity that has been identified set of components into a hierarchical structure of AHP. In general, these components will be divided into level 1 contains the purpose / goal), 2-level load management criteria to be achieved, making the component level 3 barrier (limit factor) management, and the lowest level includes co-management options offered. Hierarchy structure is organized and inputted data using AHP program.

Simulation is an activity running from structure hierarchical using data that has been inputted into the program. Once the simulation results achieved in stages, the statistical test. Statistical tests were performed in the AHP analysis, there are two types, namely the consistency test and sensitivity test. When the simulation results obtained from the inconsistency ratio of 0.1 or more means that the data used are not consistent and should be the replacement of the data. Test sensitivity is focused on the model of co-management priorities (selected), and the results are expected not too sensitive. The test results show that the model is sensitive co-management elected to be volatile against the evolving dynamics in the shrimp fishery activities in Cilacap regency, Central Java.

## 3. Results

### 3.1 Internal-External Factors Shrimp Fisheries Management

#### 3.1.1 Internal Factors of Small-Scale Shrimp Fisheries Management

Shrimp fishing activities in Cilacap regency, Central Java generally use gear arad nets, trammel net, apong nets, and lampara dasar. Fishing gear is cultivated on a small scale and generally use boats under 5 GT. Table 1 presents the results of the SWOT analysis of related factors that play an important role in the management of the shrimp fishery in Cilacap regency particularly from internal actors of small-scale shrimp fisheries.

Table 1. Internal factors of small-scale shrimp fisheries management (IFAS matrix)

Internal Factors	Weight	Rating	Score
<b>Strength:</b>			
Catching skills hereditary	0,20	4	0,80
Sharing system that is proportional catching shrimp	0,05	3	0,15
High fishing participation in conservation programs shrimp	0,12	4	0,48
Independence in making fishing gear shrimp	0,09	3	0,27
Supervision arrest by Community Based Surveillance (CBS)	0,05	3	0,15
<b>Weakness :</b>			
Fisherman Education is Low	0,15	1	0,15
Total catches tend to fall	0,12	2	0,24
MOU May 10th, 2012 Violations	0,05	1	0,05
The ability of low capitalization	0,09	2	0,18
Awareness about environmentally friendly catching	0,08	2	0,16
<b>Total</b>	<b>1,00</b>		<b>2,63</b>

Based on Table 1, hereditary skill in catching shrimp and high participation in conservation programs shrimp fishing is an important factor influencing the strength of forward and backward in determining small-scale shrimp fisheries activities in Cilacap regency, Central Java Province. These skills determine the success of fishermen in catching shrimp (weight = 0.02) and was felt by all shrimp fishermen because 100% of them (3000's people) are local residents who receive referrals directly from parents skills (rating = 4) . For participation, fishermen always participated ranging from planning, implementation and monitoring of shrimp conservation programs initiated by the government or private (weight = 0.12, rating = 4).

Independency of fishermen in the manufacture of shrimp fishing gear is also quite instrumental to the advancement of fisheries in Cilacap regency (weight = 0.09; rating = 3). This independence can not be separated from shrimp fishing position as a local fisherman. Education of fishermen and the number of catches in the shrimp fishery activities affect Cilacap regency, these effects tend to weaken the activity of this fishery. This is demonstrated by the weight of education and the number of fishermen catches relatively high, respectively 0.15 and 0.12, but the fact that occur in the field, education shrimp fishermen in Cilacap regency 90.32% Elementary School (rating = 1) and catches are also likely to go down an average of 2.97% in the last 5 years (rating = 2). The ability of individual capitalization shrimp fishermen are generally not able to help the needs of the business (weight = 0.09). But the reality of fishermen who are members of fishing cooperatives improvise with savings and credit activities with other members (rating = 2), so it can be expected although still low (score = 0.18). Violation of the Memorandum of Understanding signed on May 10, 2012 and awareness of environmentally friendly fishing methods that lower the weak points of shrimp fishermen in Cilacap regency in support of small-scale shrimp fisheries management, especially by applying the principle of co-management. The ability of low capitalization, violation of the Memorandum of May 10, 2012, and eco-friendly awareness about catching a low, is also a weak point of the shrimp fishermen in Cilacap regency in favor of small-scale shrimp fisheries management, especially by applying the principle of co-management.

### 3.1.2 External Factors of Small-Scale Shrimp Fisheries Management

The interaction of the management undertaken by local government officials, private sector and other stakeholders in the location as well as the dynamics of global fisheries can not be separated from the activities of small-scale shrimp fisheries in Cilacap regency. Table 1 presents the results of the SWOT analysis of the external factors derived from these interactions.

Table 2 External factors of small-scale shrimp fisheries management (EFAS matrix)

External Factors	Weight	Rating	Score
<b>Opportunities:</b>			
Support agencies involved in the management of mangrove areas	0,18	3	0,54
Open-close system of catching shrimp	0,06	3	0,18
introduction of environmental programs on fisheries since elementary school	0,08	3	0,24
Significant role of private sector in the management of the shrimp fishery	0,11	4	0,44
The high selling price of shrimp	0,07	4	0,28
<b>Threats:</b>			
Pollution of the aquatic environment by industrial activities	0,07	2	0,14
Waters of space use conflict	0,16	1	0,16
Illegal logging and land conversion of mangrove	0,11	2	0,22
Sedimentation of fishing ground area	0,06	2	0,12
Local Government Intervention in the disbursement of CSR funds	0,08	1	0,08
<b>Total</b>	<b>0,98</b>		<b>2,40</b>

Based on Table 2, support agencies involved in the management of mangrove areas and the significant role of the private sector in the management of the shrimp fishery is an external factor that gives great opportunities for advancement and the role of small-scale shrimp fisheries in Cilacap regency, Central Java Province. To support the management, quite a lot of relevant agencies in Cilacap regency that can help such DMFRSRSA Natural Resource Conservation, Watershed Management Agency and the Department of Forestry (weight = 0.18), and the accumulation of agency programs are pretty high (rating = 3) in both the form of education, training, and mentoring. The role of private sector is very significant, especially through the distribution of funds to fishermen CSR (rating = 4). The selling price of shrimp is high, which reached Rp 35,000 - Rp 60,000 per kg very helpful family fishermen (rating = 4). Fisheries environmental recognition programs ranging from elementary school is also helpful for the preservation of shrimp resources in Cilacap regency.

Waters of space use conflict and illegal logging and conversion of mangrove land is the greatest threat to the survival of shrimp fishing activities in Cilacap regency (weights respectively 0.16 and 0.11). However for illegal logging and land conversion of mangrove slightly reduced in the past year (rating = 2, the score = 0.22) due to the patrol programs conducted by rangers in cooperation with CNR (Conservation and Natural Resources) and DMFRSRSA. Pollution of the aquatic environment by industrial activities and local government intervention in the distribution of funds also affects CSR and quite threatening activities of small-scale shrimp fisheries. Pollution of the water environment is mainly caused by industrial waste, petroleum, electricity, and cement production located in Cilacap regency, Central Java Province.

Referring to Figure 1, note that the condition of the shrimp fishery management in the Cilacap regency, Central Java, located in quadrant V (growth / stability). In accordance with the provisions of SWOT, that an economic activity can be resumed when the minimal growth conditions (IFAS total score > 2 and a total score of EFAS > 1). The total score of IFAS and EFAS of small-scale shrimp fisheries activities in Cilacap regency, Central Java, in the range of 2-3, which is respectively 2.63 and 2.40 (categorized quite well), so that small-scale shrimp fisheries activities can be resumed and developed, including by applying the principle of co-management.

### 3.2 Components Affecting Establishment of Co-management

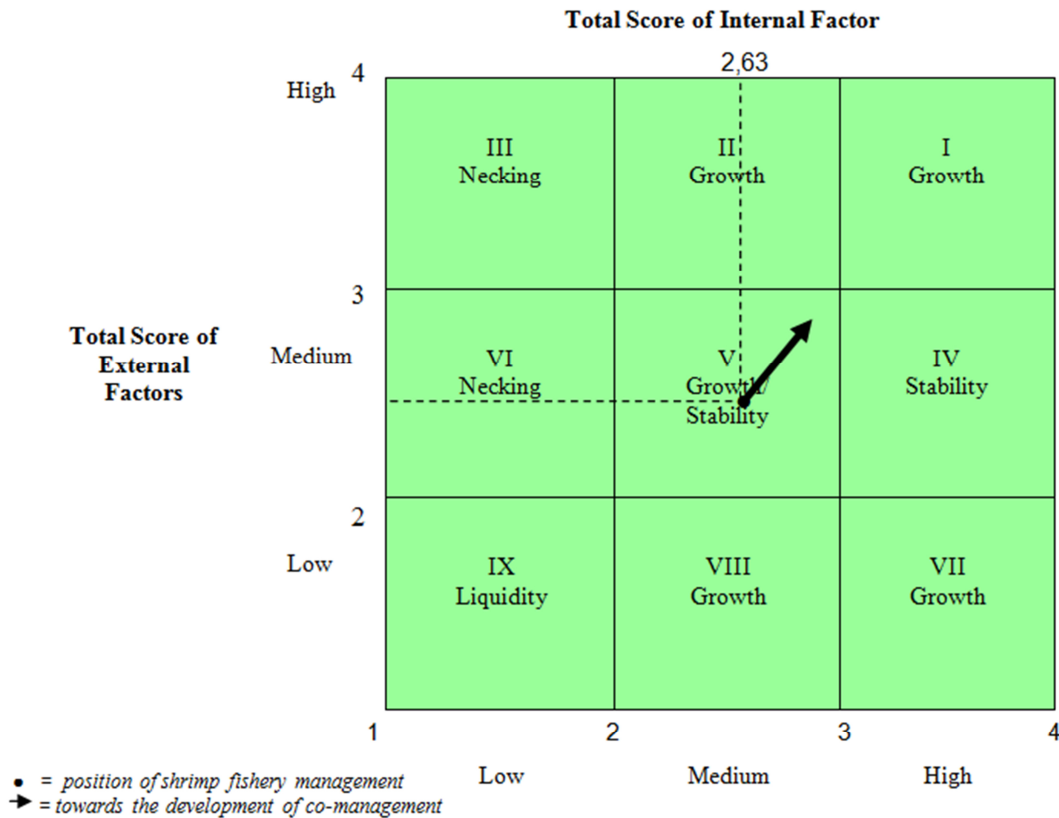


Figure 1. IE matrix of small-scale shrimp fisheries management

Components that affect establishment of the co-management of small-scale shrimp fisheries are generally divided into two components which form the criteria to be achieved in the establishment of co-management and component becomes limiting (limit factor) the achievement. From the results of the identification is done, there are four components of criteria to be achieved in the establishment of co-management, namely ecological criteria, the criteria of technological, social and economic criteria, and institutional criteria. While the barrier component (limit factor) consists of resources, membership, legal, facilities and infrastructure, as well as authority. AHP analysis results related to the level of influence of the criteria component is presented in Figure 2.

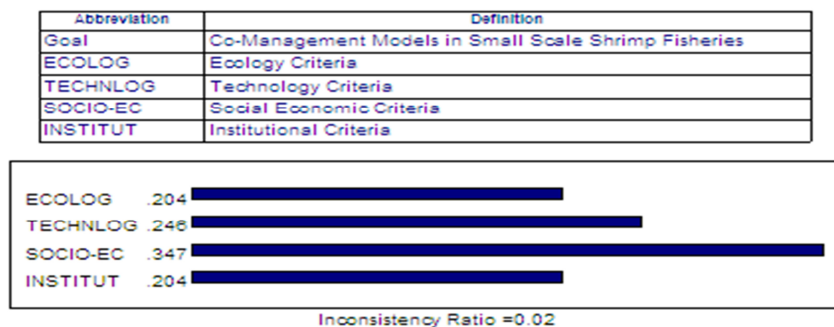


Figure 2. Level of influence in the establishment of the component criteria of co-management of small-scale shrimp fisheries

Based on Figure 2, the socio-economic conditions of society (socio-economic criteria) is a component of the criterion of the most influential in the formation of the co-management of small-scale shrimp fisheries. This is indicated by the ratio of interest (RoI) from the highest socio-economic criteria than the criteria of four components, namely, 0.347. The RoI value can be trusted because it has value inconsistency ratio (IR) < 0.05, which is 0.02. Shrimp fisheries technology used (technological criteria) is a component of the second order criteria that influence the establishment of co-management is indicated by the ratio of interest (RoI) 0.246 to 0.02

IR (reliable).

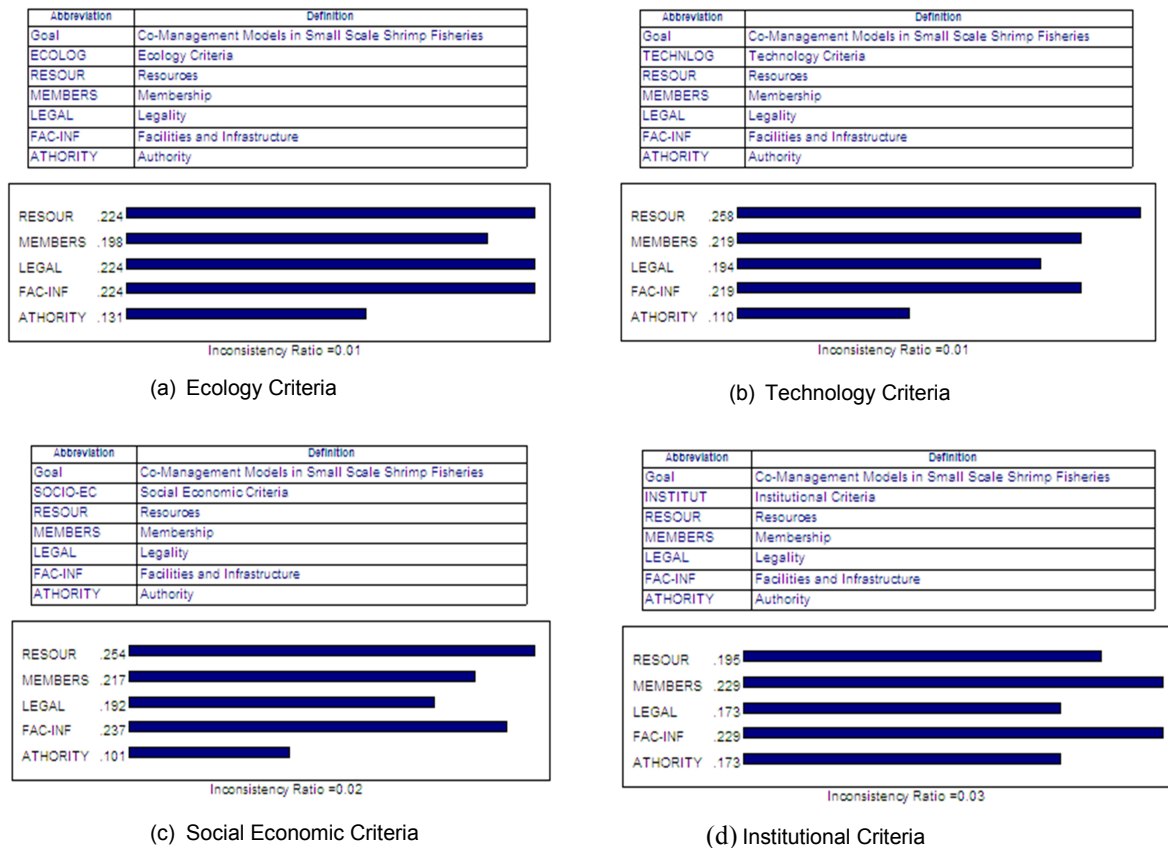


Figure 3. Level of influence limiting component in the establishment of co-management criteria for each management

When the achievement of ecological criteria take precedence (Figure 3a), then the condition of the shrimp resources, co-management membership status, and the legality of the shrimps is the limiting component of the most influential in the establishment of the co-management of the shrimp fishery in Cilacap regency. This is indicated by the ratio of interest (RoI) respectively high, namely 0.224 on the inconsistency ratio (IR) of 0.01 (reliable). Meanwhile, when the achievement of technological criteria take precedence in the establishment of the co-management of the shrimp fishery in Cilacap regency, the most influential component is the limiting condition of the resource shrimp (Figure 3b). The value of the ratio of interest (RoI) of the resource at 0.258 inconsistency ratio (IR) of 0.01 (reliable). The second component is the limiting effect of membership status and condition of the co-management of fisheries infrastructure (RoI respectively 0,219 on inconsistency ratio (IR) reliable 0.01). Authority related agencies are components of the lowest barrier effect when achievement criteria take precedence in technology establishment of co-management of the shrimp fishery in Cilacap regency (RoI = 0.110; IR = 0.01).

When the achievement of socio-economic criteria take precedence, then the limiting component of the most influential in the establishment of the co-management of the shrimp fishery in Cilacap Regency is the condition of the shrimp resource indicated by the ratio of interest (RoI) 0.258 on inconsistency ratio (IR) 0.02 (reliable) (Figure 3c). Meanwhile, when the achievement of institutional criteria take precedence, the most influential is the membership status of co-management and fishery infrastructure conditions indicated by RoI respectively 0,229 on inconsistency ratio (IR) reliable 0.03 (Figure 3d).

### 3.3 Co-management Model for Managing Small-Scale Fisheries Shrimp

Nikijuluw (2002) and Berkes (1994) stated that the model of co-management, there are five types, namely the co-management instruction (instructive), co-management consultative (consultative), co-management cooperative (cooperative), co-management advocative (advisory), and co-management informative (informative). In this section, the fifth type of co-management is analyzed and determined where appropriate and sustainable to support small-scale shrimp fisheries management. Figure 4 presents the results of the analysis using AHP method.

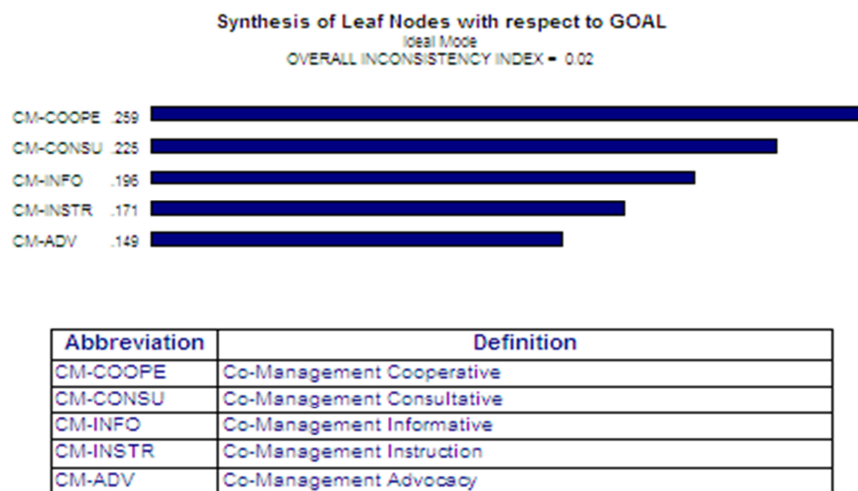


Figure 4. Priority model of co-management in support of small-scale shrimp fisheries management

Based on Figure 4, shows the results of co-management cooperative that is a model of co-management is most appropriate (priority I) to support small-scale shrimp fisheries management in the Cilacap regency, Central Java. This is indicated by the value of the Ratio of Interest (RoI) most high, namely 0.259 on inconsistency ratio (IR) reliable 0.02. Consultative co-management is a model of co-management priority II that can support the management of small-scale shrimp fisheries (RoI = 0.225; IR = 0.02) and can be a back-up of a model of co-management cooperative to support sustainable shrimp fishery.

Co-management advocacy lowest support for the sustainable management of small-scale shrimp fisheries in Cilacap regency, Central Java. RoI high value of the co-management cooperative gives an indication that the current position, especially with the existence of a limiting component or components of the shrimp fishery success criteria, then the co-management cooperative is a model of co-management that can be applied among the best five models of co-existing management. The position of the shrimp fishery in quadrant matrix V IE (SWOT analysis) indicated that the activities of small-scale shrimp fisheries in Cilacap regency, Central Java will still grow and evolve. To accelerate the growth of stable, cooperative model of co-management are the best option, especially for work the cooperation of fishermen, fishery private, and government interaction in a relatively intensive in Cilacap regency, Central Java.

#### 4. Conclusions and Recommendations

##### 4.1 Handling Internal-External Factors of Small Scale Shrimp Fisheries Management

Arad nets, trammel net, apong nets, and *lampara dasar* are fishing gear that used to catch shrimp in Cilacap regency, Central Java. Specially arad nets and trammel net rather specific in operations, so it takes a special guided fishing skills and heredity. This causes the skill factor (Table 1) is considered an important influence on shrimp fishing activities in Cilacap regency. According to Park, et. al (2011) and Pangesti (2011), the operation of shrimp fishing gear generally involving members of family, because the number of crew is not too much. For example arad nets, only need 4-5 people for each trip operation, so the core members of family may be involved fully. Transfer of skills Pattern to the direct involvement members of family in the fishing activity is much occurred in Cilacap regency.

Highly participation of fishermen in shrimp conservation programs (Table 1) evidenced from SEM analysis results indicated that the involvement of fishermen is very significant to conservation programs that held by government and private sector in the planning, implementation, and monitoring activities. Subagyo (2005) states that at 3 locations mangrove seedlings planting in Cilacap regency, the region Segara Anakan, the west coast of Nusakambangan, and Penyu bay, fishermen always take part with the highest number of participants. Meanwhile, according Pangesti (2011) and Sumiono et. al (2012), the 12 cases of illegal fishing in Cilacap 2011, 10 of which are known from voluntary supervision fishermen.

Fishermen education and the amount of fishing is also important influence, but to weaken the shrimp fishery management. For education, because 90.32% of shrimp fishermen in Cilacap regency elementary graduates, 9.68% junior high school graduates, and no one high school or college graduates. Meanwhile, according Hendratmoko and Marsudi (2010) and Pomeroy, et. al (1999), low education inhibits the transfer of fishing technology based primarily digital, as well as creating employment pattern of undisciplined and irresponsible. It should be an important concern, especially in applying the principles the shrimp fishery of co-management in Cilacap regency.



The number of shrimp catches tend to decrease presumably because utilization status of shrimp in southern Central Java has been over exploited. This is shown by the results of research Sumiono, *et. al* (2012), where the effort realization reached 3358 units, whereas only 2164 units of the optimum effort equivalent MSY trammel net and penaeid shrimp (vannamei category, jerbung, dogol and others) in the waters around 3,277 tonnes / year. For capital, is quite difficult to fulfill independently by individual fishermen, because 85% of low-income shrimp fishermen (15% earning < Rp 1,000,000 per month or < Rp 33,000 per day and 60% earn Rp 1.000.000 - Rp 3,000,000 per month or Rp 33000-100000 per day). While the need to sail by using a system of one day fishing the shrimp fishermen around Rp 75,000 - Rp. 150,000 each trip (DMFRSRSA, 2014).

Agencies support involved in the management of mangrove areas (Table 2) is also an important influence in support of the shrimp fishery in Central Java. According DMFRSRSA (2011) Regional Regulation No. 16 of 2001 about Fisheries Management in Segara Anakan Area and Regional Regulation No. 6 Year 2001 about Mangrove Area Plan Segara Anakan are very protective of populations of shrimp resource from destructive fishing activities, although the participatory function still felt not maximal. In addition, mangrove protection programs, estuaries and rivers carried out by Natural Resources Conservation Center (NRCC), Center for the Management of River Citanduy (CMR Citanduy) and the Center for Watershed Management in Cilacap regency also helps keep the migratory area and shrimp habitat. The role of the private sector (Table 2) also support the management of the shrimp fishery especially the disbursement of CSR. According DMFRSRSA (2014) and PT. Holcim (2013), CSR funds from the private sector commonly used for mangrove seedlings, aid facilities and gear, coaching capitalization, and socialization of area management. It is very important to raise awareness and independence so that the management of the shrimp fishery goes well.

Ranger patrols in cooperation with CNR and DMFRSRSA to prevent illegal logging and land conversion of mangrove begin initiated at the beginning of 2013. According to the FGD Drafting Team (2013), in addition to the space utilization conflict, illegal logging and land conversion of mangrove into a serious threat to the sustainability of the resource and collaborative management of the shrimp fishery, so the FGD on 19-20 November 2013 these issues were raised and reaffirmed the joint commitment made by the patrol unit forestry (forest rangers) Natural Resource Conservation Center, and DMFRSRSA. Patrol mangrove areas such as mangrove Segara Anakan, Penyub Bay mangrove and mangrove about reclaiming the West coast became one of the activities in fact.

#### 4.2 Application Referral of Model Co-management of Small Scale Shrimp Fishery

Socioeconomic criteria of the most influential in the formation of the co-management of small-scale shrimp fisheries (Figure 2) allegedly due directly related to social interaction and life of shrimp fishermen. This interaction can be related with the procurement of fishing, marketing of products, the needs of life, children's education, family health and other that needed by the fishing community. According to Aswani, *et. al* (2013) and Hendratmoko and Marsudi (2010), most of the fisherman's life related to sub system and interactions that align their lives as members of society. Related to this, the implementation of co-management of the shrimp fishery should be directed to develop patterns of socio-economic interaction in harnessing the potential of the existing shrimp resources, resulting in an increase in the standard of living, economic growth, and harmony with nature and community interaction. Government and the private sector can drive and take an important role through programs that encouraged small-scale fishing communities.

This is particularly relevant to the concept of co-management cooperative as a model of co-management for small-scale shrimp fisheries (Figure 3). Co-management cooperative giving full space for fishermen to participate, contribute, and interact in support of the shrimp fishery in accordance with the values and interests to advance the socio-economic life. Makino, *et.al* (2009) stated that the implementation of co-management cooperative, the community is no longer positioned as an object, but to be part of the offender and initiators of policies and programs that will be done. Meanwhile, according Nikijuluw (2002) and Pomeroy, *et. al* (1999), co-management cooperative is an ideal type of co-management, where the role of government and a balanced community with a program (usually from the private sector through CSR funds) in policy-making and planning.

The results of the analysis at Figure 3a-3d shows that the condition of the resource and fishery infrastructure is a major barrier in the implementation of co-management of the shrimp fishery. The research results of Sumiono, *et. al* (2012) showed that the size of the resource commercial penaeid shrimp (vannamei, jerbung, dogol category) in the south of Java that the potential for sustainability until 1147 tonnes / year already over-exploited status, where his effort in 2009 reached 4023 units and 3358 units in 2010, while The optimum effort only 1865 units of equivalent trammel net. While fisheries related infrastructure, small-scale shrimp fishing are need of cold-storage building in the center of the fishery so low handling costs, product quality, especially when production blooming awake and the selling price is not stable.

Implementation of co-management cooperative models need to be directed to find solutions related to the limiting factor and FGD on 19-20 November 2013 has given some recommendations. To optimize conservation resource efforts shrimp, the suggested revision FGD By Local Regulation No. 16 in 2001 on Fisheries

Management in the Segara Anakan area and revision of By Local Regulation No. 6 in 2001, about Segara Anakan Area Plan, and this needs to be done with the involvement of government representatives, fishermen, and private (FGD Drafting Team, 2013). In the revision, fisherman information and the problems it faces should be heard, as well as input from the private sector as a sponsor. It is important that the results of the revised regulations can actually be run primarily by fishermen as a person in the field and can significantly be optimized to preserve the shrimp resource. So is its implementation in the form of a program funded by the CSR, must be in accordance with the expectations of the private sector so that the fund continues to sustainable in the future.

Associated with cold storage, can be built in cooperation with the private sector or by utilizing CSR funds that allocated for facilities and coaching assistance capitalization (Sumiono, *et al.*, 2012 and Pangesti, 2011). During this time, the role of the private sector through CSR funds become very significant and both external factors (Table 2), which supports the management of the shrimp fishery in Cilacap regency. Many private sector help including Pertamina, Holcim, and Cilacap PLTU. Private sector involvement in co-management should be encouraged, especially for improving fisheries management position that is currently in a stable growth (Figure 1). Meanwhile, according DMFRSRSRSA (2014), this can be done between the merger company as a potential new source of funding of CSR, such as iron sand mining in the regency Adipala and Jetis, PT. Toksindo, and Susi Air that support air transportation.

The role of the balance between the public and government to support the private sector initiated through cooperative co-management can accelerate the region's economic growth and revenue contribution of the fisheries sector. According Nikijuluw (2002) and Pomeroy and Berkes (1997), the involvement of fishermen in policy making and planning will increase the confidence of fishermen, ownership of the program, and had risen participation in regional economic development, especially through alternative economic development. Some forms of economic alternatives that can involve the participation of shrimp fishermen (FGD Drafting Team, 2013 and Zarochman, 2001) is the creation of value added (value added) products through the shrimp business processing household scale, diversification of shrimp fishing gear that may be fishing in marine shrimp catches during quiet, ecotourism development and cultivation of milkfish bait, as well as the involvement of fishermen as guides for natural mangrove forests.

## 5. Conclusions and Recommendations

### 5.1 Conclusions

Internal factors which influence the management of small-scale shrimp fisheries are: (a) force, consisting of the fishermen catching skills and participation and (b) weakness, consists of a number of the catch and the ability of capital. While external factors are: (a) opportunities, consisting of relevant agencies and support the significant role of the private sector, and (b) a threat, is composed of illegal logging and conversion of mangrove land, and conflicts of the utilization of the waters of space. Components becomes an important criterion in the establishment of the co-management of small-scale shrimp fisheries is the socio-economic conditions the fishermen (RoI = 0.347; IR = 0.02), whereas the main limiting component is the condition of the resource as well as the condition of fishery infrastructure. Model appropriate co-management in small-scale shrimp fisheries management in the Cilacap regency is a co-management cooperative (RoI = 0.259; IR = 0.002). Co-management consultative can back-up of the co-operative model of co-management to support sustainable shrimp fishery.

### 5.2 Recommendations

To support the implementation of co-management cooperative on small-scale shrimp fisheries are advised to set up the governing body. It included representatives from related stakeholders like the fishermen, private, Marine Department, Fisheries and Resource Management Regions of Segara Anakan (DMFRSRSRSA), and coastal communities. The governing body will eventually run co-management activities from planning, program realization, and monitoring. Joint Business Group (JBG) existing the fishermen can be optimized in the program, especially related to economic development alternatives that were funded by CSR. In periodically, eg every 6 months or 1 year, the governing body of the report on the implementation of the co-management related stakeholders submitted.

## References

- Aswani, S., G.G. Gurney, S. Mulville, J. Matera, and M. Gurven. 2013. Insights from experimental economics on local cooperation in a small-scale fishery management system. *Journal of Global Environmental Change*, Vol 23 (6) : 1402–1409
- Berkes, F, 1994. Property Rights and Coastal Fisheries, p 51-56. In Pomeroy, RS (ed) *Community Management dan common Property of Coastal Fisheries in Asia and The Pasific*; concepts, methods and experiences ICLARM Conf. Proc. 45, 189 p.
- Dahuri R., Rais Y., S. Son, G., Sitepu, MJ, 2001 *Coastal Resource Management and Integrated Ocean*. PT. Pradnya Paramita, Jakarta.

- Department of Marine and Fisheries (DMF) Central Java Province. 2013. Fisheries Statistics 2013, Central Java Semarang.
- Department of Marine, Fisheries and Resource Management Regions Segara Anakan (DMFRSRSR) Cilacap Regency. 2014. CSR Overview Fisheries Sector Fund Distribution. DMFRSRSR Cilacap regency. Cilacap. 38 p.
- Department of Marine, Fisheries and Resource Management Regions Segara Anakan (DMFRSRSR) Cilacap Regency. 2011. Annual Report of the Department of Marine, Fisheries and Resource Management Regions Segara Anakan (DMFRSRSR) 2010 Cilacap Regency. 57 p.
- Hendratmoko, C., and Marsudi, H. 2010. Analysis of the level of socio-economic empowerment of the fishermen fishing in Cilacap regency. *Journal of Socio-Economic Dynamics*, 6 (1): p 17, May 2010 edition.
- Mustaruddin, Nuraini, TW, Wisudo, SH, Wiyono, ES, and bow, 2011. J. Quantitative Approach for the Development of Industrial Fisheries Operations. CV. Great depths. Bandung.
- Nikijuluw, V.P.H. 2002 Fisheries Resource Management Regime. Regional Empowerment and Development Center, Jakarta.
- Pangesti, T.P. 2011. *Penaeidae spp Resource Management Model in Cilacap Regency, Central Java province*. Graduate School. Bogor Agricultural University. Bogor. xv + 73 p. (Thesis).
- Park, H.H., Millar, R.B., Bae, B.S., Chun, A.H., Chun, Y.Y., Yang, J.H., and Yoon, S.C. 2011. Size selectivity of Korean flounder (*Glyptocephalus stelleri*) by gillnets and trammel nets using an extension of SELECT for experiments with differing mesh sizes *Fisheries Research*, Vol 107 (1-3) : 196-200.
- Pomeroy, R.S, B.M. Katon and I. Harkes. 1999. *Fisheries Co-management : Key Conditions and Principles Drawn from Asian Experiences*. International Center for Living Aquatic Resources Management, Philippines.
- Pomeroy, R.S and F. Berkes. 1997. Two to Tango : The Role of Government if Fisheries Co-Management. *Marine Policy*, Vol 21(5) : 465-480
- Pomeroy, R. S. and M. J. Williams. 1994. *Fisheries Co-Management and Small Scale Fisheries : a Policy Brief*. ICLRAM, Manila. 15 p.
- PT. Holcim. 2013. Performance Community Empowerment (CSR) PT. Holcim Indonesia Tbk. Cilacap.
- Rangkuti F. 2006. SWOT Analysis Technique Dissecting the Business Case. PT Gramedia Pustaka Utama.
- Saaty, T.L. 1991. *Decision Making For Leaders*. PT. Library Binaman Pressindo, Jakarta. 270 page.
- Subagyo, W. 2005 Status of Arrest Jerbung Shrimp (*Penaeus merguensis De Man*) in Cilacap and Surrounding Waters and The management proposal. Graduate School Dissertation, IPB. Bogor. ix + 246 p.
- Sumiono, B., Hargiyatno, IT, Solomon, PS, Anggawangsa, R. F, and Wudji, A. 2012 Alternative Study of Shrimp Fisheries Co-management in South Central Java Aquatic and Fishery Teri In the Madura Strait. Research Center for Fisheries Management and Conservation of Fish Resources, BRKP - CTF RI. Jakarta. 72 p.
- Drafting Team FGD. 2013. Formulation of Focus Group Discussion (FGD) Shrimp Resource Management Policy Analysis in South Central Java For Co-management Development. Hotel Dafam, 19-20 November 2013 in Cilacap.
- Law Number 32, 2004 regarding Regional Government. Secretariat of the Republic of Indonesia.
- Zarochman. 2001 Structuring Apong to grow shrimp in the area of safety Segara Anakan. *Journal Gema Segara Anakan* ISSN 1411-1160. Vol 3 (9): 12-21

### Acknowledgement

The authors would like to thank Prof. Dr Hari Eko Irianto, M.Sc., Head of Research Center for Fisheries Management and Conservation (RCFMC) Ministry of Marine Affairs and Fisheries and Drs. Bambang Sumiono, M.Sc., Senior Research RCFMC, who have helped and provided input during the study. We also wish to thank Ir. Moch.Harnanto, MM, Head of Department of Marine, Fisheries and Resource Management Regions Segara Anakan (DMFRSRSR) Cilacap Regency, for permission for research in Cilacap Regency. We hope that this research is beneficial to the development of the fisheries sector in Cilacap Regency.

**Drama Panca Putra, S.Pi., MS.i.** This author became a member of Communication and Partnership Forum of Capture Fisheries (CPFCF) (2011). He was born in Bandar Lampung, Indonesia, September 30<sup>th</sup>, 1975. He lives in West Jakarta, Indonesia. The author's educational backgrounds are Bachelor degree from Faculty of Fisheries, IPB Bogor (1997) in the major of Marine Science and Technology (SP.i). Master degree from Faculty of Fisheries, Bogor Agricultural University (2001) in the major of Marine and Coastal Management (MSi). Currently the author is a student at the Post Graduate School in Department of Modeling Systems of Fisheries, Bogor Agricultural University. He is also a officer of Ministry of Marine Affairs and Fisheries of Republic of Indonesia.

**Mulyono S Baskoro, Ir., M.Sc.,Ph.D., Prof.** This author became a Member (M) of Japanese Society of Scientific Fisheries in 1993 until 2002, Member of Fishing Technology Net Work in 1995, Head of Marine Field Station, Faculty of Fisheries and Marine Science, IPB in 2001 until 2004, Counselor of Indonesian Agricultural Sciences Association in 2002 until 2003. He was born in Semarang at March 03<sup>th</sup>, 1962. The author's educational backgrounds are Bachelor degree from Faculty of Fisheries, Bogor Agricultural University (1987) in the major of Science in the field of Fisheries (Ir), Master degree from Tokyo University of Fisheries, (1995) in the major of capture fisheries (M.Sc.), Doctor degree from Tokyo University of Fisheries (2000) in the major of Fishing Gear (Ph.D). Currently the author is a lecturer in Department of Modeling Systems of Fisheries at the Post Graduate School of Bogor Agricultural University.

**Wudianto, Ir., M.Sc., Dr.** This author became a Member of Indonesia Tuna Commission, Coordinator of Research Group on Marine Fisheries Management Policy at Research Center for Fisheries Management and Conservation (RCFMC) Ministry of Marine Affairs and Fisheries, Secretary of Commission for National Fish Stock Assessment. He was born in Mojokerto, East Java at October 27<sup>th</sup>, 1959. He lives in Depok City, West Java, Indonesia. The author's educational backgrounds are Bachelor degree from Faculty of Fisheries, IPB Bogor (1982) in the major of Fishing Technology (Ir). Master degree from Ryukyus University, Japan, (1991) in the major of Fisheries Oceanography (M.Sc). Doctor degree from Faculty of Fisheries, Bogor Agricultural University, Bogor (2001) in the major of Fishing Technology (Ph.D). The author is researchers at Research Center for Fisheries Management and Conservation (RCFMC) Ministry of Marine Affairs and Fisheries, which is located Pasir Putih I Street, Ancol Timur, Jakarta Utara 14440, Jakarta.

**Sugeng Hari Wisudo, Ir., M.Sc., Dr.** This author became a Member of Fisheries Association of Indonesia (FAI), Member of Japanese Society of Fisheries Science (JSFS), Member of Communication and Partnership Forum of Capture Fisheries (CPFCE), Member of Asian Fisheries Society (AFS). He was born in Jakarta, September 20<sup>th</sup>, 1966. He lives in Bogor, West Java, Indonesia. The Author's educational backgrounds are Bachelor degree from Faculty of Fisheries, Bogor Agricultural University, Bogor (1991) in the major of Science in the field of Fisheries (Ir), Master degree from Faculty of Fisheries Bogor Agricultural University (1997) in the major of Science in the field of Marine Technology (MSi), Doctor degree from Tokyo University of Fisheries (TUF), Japan (2003) in the major of Marine Science and Technology (Ph.D)

**Eko Sri Wiyono, S.Pi., M.Si., Dr.** This author became a member of National Commission for Assessment of Fish Resources, member of Communication and Partnership Forum of fisheries, member of Asian Fisheries Society, Assessor of National Accreditation Board for Higher Education. He was born in Sukoharjo, November 6<sup>th</sup>, 1969. He lives in Bogor, West Java, Indonesia. The Author's educational backgrounds are Bachelor degree from Faculty of Fisheries, Bogor Agricultural University, Bogor (1994) in the major of Capture Fisheries Management (SP.i), Master degree from Faculty of Fisheries, Bogor Agricultural University, Bogor (2001) in the major of Capture Fisheries Management (MSi), Doctor degree from Tokyo Univ. of Marine Science and Tech., Tokyo (2006) in the major of Capture Fisheries Management (Dr)

The IISTE is a pioneer in the Open-Access hosting service and academic event management. The aim of the firm is Accelerating Global Knowledge Sharing.

More information about the firm can be found on the homepage:  
<http://www.iiste.org>

## CALL FOR JOURNAL PAPERS

There are more than 30 peer-reviewed academic journals hosted under the hosting platform.

**Prospective authors of journals can find the submission instruction on the following page:** <http://www.iiste.org/journals/> All the journals articles are available online to the readers all over the world without financial, legal, or technical barriers other than those inseparable from gaining access to the internet itself. Paper version of the journals is also available upon request of readers and authors.

## MORE RESOURCES

Book publication information: <http://www.iiste.org/book/>

## IISTE Knowledge Sharing Partners

EBSCO, Index Copernicus, Ulrich's Periodicals Directory, JournalTOCS, PKP Open Archives Harvester, Bielefeld Academic Search Engine, Elektronische Zeitschriftenbibliothek EZB, Open J-Gate, OCLC WorldCat, Universe Digital Library, NewJour, Google Scholar

