Challenges in managing freshwater fishery resource through Lebak Lebung Auction approach: a case study in Pangkalan Lampam District Ogan Komering Ilir Regency

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Abstract. Responsible management of fishery resources has been a tradition of Ogan Komering Ilir (OKI) of South Sumatera for generations. It was recorded that since 1630 the Dutch Government had made auction policy for managing water territory in OKI Regency as an effort to preserve nature and to avoid the conflict of inland water ownership. Currently, the community-based management model has been adopted by local governments into formal regulations, known as Regional Regulation on Auction of Flood Water Swamp and Rivers (Lelang Lebak Lebung dan Sungai or L3S). This paper describes the success factors and the threats for the failure of the L3S management model in OKI Regency, based on a case study in Pangkalan Lampam District. The study showed that the management mechanism through the L3S system had been well instituted and become a well-established management practice. The management model is in line with the principle of co-management and the approach has become critical success factor in L3S management. However, ecological, economic and social aspects influence the sustainability of such fishery management model. Besides, L3S management model faces limited data and information related to fish stocks, which result in difficulties in determining the total allowable catch.

1. Introduction
As a country, which waters dominate its geography, there are numbers of challenges in managing its ocean and water resources including the fishery resources. Fish is one of the renewable resources but endangered due to over-exploitation. The threat of extinction is caused by reckless management [1]. The characteristic of common-pool resources with joint ownership system also adds the complexity of its management. This complexity is caused by the two characteristics of the commons, namely (1) free-riding problems, in which the difficulty lies in issuing or managing the resources users with physical barrier or rules and (2) sub tractability problems, where sharing the resources or obtaining the same results out of the resource’s utilization is difficult [2]. Two solutions to solve such resources management problems: (1) privatizing the resources ownership and (2) strong government control [3]. However, some other research showed the favorable outcome of resources management by society, which differs from the institutions [3, 4, 5]. Nevertheless, it needs to understand the factors or conditions for the success or failure of the common-pool resources management regime [6]. The joint-ownership pattern between the government and society through decentralization management with co-management system is seen as institutional innovation for joint-ownership resources management [7, 8, 9].
Water and fishery resources management system, so-called Lebak Lebung (flood water swamp) becomes one of the co-management patterns of the commons. Since a long time ago, the society and government came to realize the importance of utilizing limited Lebak Lebung fish resources, so it has to be managed sustainably. Such tradition is a way-of-life sustained by the government, which subsequently legitimized in recent Peraturan Daerah or Local Government Regulations. Since 1630, Ogan Komering Ilir Regency (OKI) managed its Lebak Lebung through an auction system. It mainly aims to cease the ownership conflict of waters and fishery resources as well as the regional revenue sources. Such auction system has been long known as *Lelang* (auction) *Lebak Lebung dan Sungai* (L3S). In 2015, 12 districts were conducting L3S which total 332 auction objects (Lebak Lebung) were offered, but only 260 objects in demand. With a long history and the dynamics of resources management policy until now, what is the current condition of such resources management model and what are the main challenges for the sustainability of such management model? These questions will be addressed in this paper, including the formulation of L3S or joint-ownership recommendation of resources management model policy for the future.

2. Methods

2.1. Time and location
This research was conducted in September to December 2016 in Sub-District of Pangkalan Lampam. The observation sites include 14 sites in four villages, namely Pangkalan Lampam, Deling, Sungai Bungin and Riding Village, which are parts of the public water of Lubuk Lampam. The location of field study and schedule were decided at the time of fishermen held an auction.

2.2. Data collecting and data analysis method
The primary data were collected through in-depth interview with key informants using purposive sampling techniques on the auctioneers during research. There were eight main respondents selected, consisting of two auction winners, two fishermen and three staff of Marine and Fishery Offices of OKI Regency. Secondary data was also collected from literature research, Pangkalan Lampam Districts data, Marine and Fishery Offices of OKI Regency, Statistics Indonesia of OKI regency as well as South Sumatera Province. The data then further analyzed with descriptive methods to describe the current condition of fishery resources, management and challenges of the L3S management model.

3. Results and Discussion

3.1. Description study site
OKI regency, geographically, has larger water area compared to the land, especially the common waters such as swamp (including floody swamp) and river. Lubuk Lampam one of the flood swamps area, which is the main source of the rural livelihood, both in fisheries and agricultural-related activities. This water called flood swamp area because it is affected by the tide of Lempuing River creek, which is connected with Komering River [10]. The Lubuk Lampam area is 1,200 ha, consisting Lebak Kumpai river 965 ha, the forest about 213 ha, the main river about 18 ha and Lebung (deep swamp) about four ha [11]. The Lubuk Lampam is also known as the fish reserve area, because of its potential to be reservation area for local fishes to reproduce.

The management of fishery resources in OKI regency mainly is based on the Fisheries Law or called Undang-Undang No. 45, 2009 [12], particularly on the principles of benefits, justice, unity, partnership, independence, equity, integration, efficiency, preservation and sustainable development. In line with these principles, the local government issued Regional Regulations (Perda) of OKI Regency No. 18, 2010 about L3S management, which subsequently renewed into Perda No. 14, 2015. This rule regulates the L3S management and the allowed or disallowed fishing equipment.
3.2. Fish production

Total fish production based on target species in Lubuk Lampam experienced fluctuation. In 1992, there were 63 species from 19 fish families found, but in 2008 there were only 48 species. However, in 2013 there were 63 fish species found [11]. The fish production based on the number of catch shows a declining trend. In 1997, the fish production reached 93 ton, while in 2012 it fell to 81 ton [11]. The Marine and Fishery Offices of OKI Regency recorded the number of catches using the L3S method in 2016 as 311 ton (Table 1).

**Table 1.** Recorded the number of fish catches using L3S method in 2016.

| Fish species               | Amount of fish caught (kg) | Percentage (%) |
|----------------------------|----------------------------|----------------|
| Helostoma temmincki        | 59,164                     | 19             |
| Ophiocephalus micropereltis| 55,042                     | 17.7           |
| Anabas testudineus         | 42,712                     | 13.7           |
| Ophiocephalus striatus     | 31,238                     | 10.0           |
| Others                     | 27,432                     | 8.8            |
| Clarias gariepinus         | 24,254                     | 7.8            |
| Rasbora sp.                | 16,324                     | 5.2            |
| Pangasius sp.              | 15,250                     | 4.9            |
| Oreochromis nilotocus      | 15,250                     | 4.9            |
| Trichogaster trichopterus  | 13,592                     | 4.4            |
| Barbnymous schwanenfeldii  | 8,650                      | 2.8            |
| Mytus sp.                  | 1,570                      | 0.5            |
| Monopterus alabas          | 600                         | 0.2            |
| Hemibagrus hoevenii        | 300                         | 0.1            |
| Total                      | 311,378                    | 100            |

3.3. Types of fishing gears

In general, the fishers utilize 10 types of fishing gears in Lubuk Lampam of OKI regency. In Pedamaran District, fishers use *kilung empangor* (fike net), *lulung-empang* (filtering barriers), *jaring insang tetap* (set gill nets), *jaring insang hanyut* (drift gill nets) and *pancing tajur* (hook and line), *jala* (cast nets), *bubu* (portable traps), *rawe* (long line).

**Table 2.** The fishing gear depends on the ebb and flow of the water tide in Pedamaran District.

| Fishing Equipments | Amount (pcs) | Periods          |
|--------------------|--------------|------------------|
| Filtering barriers | 100          | Flood tide       |
| Drift gill nets    | 400          | Between periods  |
| Hook and line      | 1.2          | Flood tide       |
| Cast nets          | 90           | Low tide         |
| Portable traps     | 400          | Between periods  |

The utilization of the fishing gear depends on the river tide. As seen in table 2, fisher in Pedamaran District use several fishing gears because of various types of ecosystem in the district, such as reeks and swamp. Meanwhile, in Pangkalan Lampam District fishers only use few types of fishing gears, because the water area mostly consists of Lebak and Lebung (floody and deep swamp area). Based on the interview with fishery extension workers, there are five types of fishing equipment that are dominantly used based on the ebb and flow of the tide in the study site. During high tide on October to March, the fishers use *pancing tajur* (hook and line) and *jala* (cast net). However, if the water only reaches the medium height in March to May, the fishers use the *lulung empang* (filtering barriers) and *pancing tajur* (hook and line). Meanwhile, during the dry season on May to October, the main fishing gears are drift.
gill nets, cast nets and traps. Nevertheless, there is also challenge during this dry season that is the occurrence of environmentally unfriendly fishing practice using setrum (electric fishing gears). Such method directly causes the decline of fish stock in Lebak Lebung. Regional regulation No. 18, 2010 and No. 29, 2010 have stated the recommended fishing gears such to trap, gillnet and hook and line. The rule also depicted forbidden fishing gears such as tuguk (not selective fishing gears), cyanide and electricity. Also, those regulations also control the type and size of fishes, which are not allowed to catch (restriction of catching, carrying and selling fishes with the size of 2.5 cm to 20 cm) in table 3.

| Table 3. Prohibited size of fishes to catch. |
|---------------------------------------------|
| Common names       | Species              | Total length (cm) |
| Snakehead          | O. Striatus         | < 15              |
| Giant snakehead    | O. micropeltes      | < 20              |
| Ocellated snakehead| O. pleurophothalamus| < 15              |
| Splendid snakehead | O. maruloides       | < 10              |
| Emperor snakehead  | O. maruloides       | < 10              |
| Bangka snakehead   | O. bankenensis      | < 10              |
| Kissing gourami    | Helostoma temmincki | < 2.5             |
| Siamese gourami    | Trichogaster pectoralis | < 2.5          |

Fishing activities during March to May where the water level reaches medium height are deemed to be the most productive as the fishermen could obtain the maximum results, especially for snakehead (Channa spp.). During this season the catch could approximately reach 200–240 kg of snakehead. According to the interviews with the pengemin (the fisher who win the auction) and fishery extension worker, there were few fish species with bountiful numbers within the last two years, mainly sapu-sapu (Hyposarcus pardalis), lundu (Arius maculatus) and catfish (Clarias spp.). On the other hand, the rare species were baung or local catfish (Hemibagrus nemurus), tapa (Wallago leeri) and selincah (Belonta hasselti). Based on this information, the group of introduced carnivore species such as catfishes started to dominate fish caught and such trend could be another challenge for future management of fishery resources.

3.4. Lelang lebak lebung dan sungai (L3S) model

The local government has regulated mechanisms for managing floody swamp area and river (L3S) in OKI Regency, in which the people of OKI regency could have a chance to join the auction. The auction winner (pengemin) will be given rights to utilize the waters and fisheries for one year according to the existing regional (Perda) and regent’s regulations. In the Perda of OKI regency No. 14, 2015 [13] article 18, it is stated that the auction winner or pengemin is obliged to pay from the highest bid and additionally five percent as permit retribution to catch fishes in the claimed area to the treasurer. In Article 28, pengemin is also obliged to deliver reports of their fishing activities to the Office Fisheries and Marine Affairs every month, including a) type of fish, b) amount/weight, c) selling price and d) the fishing gears. Upon the end of managing the water area, pengemin is obliged to do restocking at least five percent from the auction values, which is managed by the local district office and to be reported to the Offices during restocking. Pengemin should also prioritize in employing the people from the local village around the auction object.
Figure 1. Standard Price Determination and Appointments committee Rural, Peraturan Bupati No. 29 tahun 2010 [13]: 1) price decision for auction determine by 1(a) proposal submission of sub-district head, 1(b) fisheries and Marine Agency OKI district and 1(c) OKI district committee; next 2) committee actor consists of government 2 (a), 2(b), 2(d) and non-government 2(c) and 3) the auction held in sub-district.

Figure 2. Auction Mechanism: 1) The auction participant could be individual 1(a), fishermen community 1(b) and Koperasi 1(c). The participant must be had citizen card of sub-district area with chosen minimal one auction objects and maximum three auction objects. After auction day (2), the winner called Pengemin must be complete the payment (4) which is can be use auction area for fisheries activity during one years and fishermen could be rent auction area from Pengemin, but if Pengemin doesn’t complete the payment, pengemin will be charged 10% or threats retained for three months.
3.5. Role of Lebak Lebung auction in regional economy
Mainstreaming the village development is the main commitment of OKI Government as clearly stated in its *Rencana Pembangunan Jangka Menengah Daerah* (RPJMD) or Medium-Term Regional Development Plans of OKI regency from 2014–2019. The fishery sector is expected to make a better contribution to the regional economy. Gross Regional Domestic Product (PDRB) of fishery sector still need to be improved and its share in 2012 was only 7.79% of PDRB OKI Regency. The existing of L3S is important to the regional economy, as depicted in its contribution to the Regional Revenue (PAD). In 2015, the total value of action stood at 5.4 billion IDR. Further, the income was redistributed based on *peraturan daerah* (Regional Regulation) No. 14, 2015 [12], which 30% of it has been used for the regency and the rest have been allocated for the villages within the district in which the auction object was located. Other allocations went to technical assistance practice and preservation as well as supervision of the fish resources conducted by the Offices. Figure 1 and figure 2 show the number of auction object and their auction values. Pampangan District contributed as the highest auction objects (62 sites) and values.

*Figure 3. Auction objects in OKI Regency.*
As shown in figure 3 available for object auction was decreased, from 385 in 2013 became 332 in 2015. It happened in Sungai Menang District, from 59 and became 10. It assumed the lowest demand for object auction causing low cash results. Otherwise, Price offer of object-action shown in Figure 4 increased from 3.1 billion rupiahs in 2013 became 3.6 billion rupiahs in 2015. The bid price of Auctioned objects in figure 4 also experienced an increase from 4.9 billion IDR in 2013 to 5.7 billion IDR in 2015. The increase occurred in several sub-districts Sold objects used as regional income of OKI Regency. The increase occurred in several districts, namely Kota Kayu Agung, Sp. Padang, Jejawi and Pangkalan Lampam. There were 20 objects in 2015 with 13 objects in-demand, while in 2016 there were 14 objects which all became in-demand. The detailed study at micro level was conducted in Pangkalan Lampam District. However, there is an interesting fact of the auction value in Rasau Gemuk Bagian Laut in 2015, where it was bid for 42.4 million IDR; while in 2016 it decreased to 9.55 million IDR (figure 5 and 6).

**Figure 4.** Auction value in OKI Regency.
Figure 5. Auction value in Pangkalan Lampam District (2015).

Figure 6. Auction value in Pangkalan Lampam District (2016).
3.6. The challenges of L3S model

The effort of managing the common-pool resources such Lubuk Lampan in OKI might be categorized as fisheries co-management. This approach has been practiced hereditarily in OKI Regency through the auction process. Under the scheme of water resources management in Pangkalan Lampam District, the managerial group is involved and given responsibility according to the auction mechanism. The L3S is an accommodative model for a joint-ownership scheme with co-management. However, seen from the characteristics of the local people, who are also the participants, the main issue to participate in L3S is the capital access and capacity. The capital issue makes it possible for outsiders to cooperate and make a special deal with local people. For example, the fishes caught by the local fishermen should be sold to pengemin with pre-determined price or the fishermen are given a chance to fish with particular payment terms. To participating in the auction, local fishermen as a pengemin candidate are required to possess a capital to register and pay the obtained auction object. Local government gives a chance to local people to participate either individually, by cooperation or group, with the prize of maximum amount auction object, which is three objects. The capital ownership access permits for outsiders to undertake capital loan with a particular deal. There is no specific criterion for local people in accessing capital from the local government, so they have the same chance in that process. Therefore the clear rule to involve the local in the process of an auction will be needed to enhance the opportunity of local to gain benefit from their available resources.

The current L3S management model is also facing the availability and sustainability of the fish stock. In fact, the fish recruitment process could occur naturally as well as artificially with the help of humans. Provision of a fish conservation area is one of the efforts to preserve fish stock, by deciding the spawning area and nursery area, each year, the OKI Regency Government stipulates these areas to forbid any fishing activities. The determination of nature reserve areas for research and conservation area for the fishes as well as allowed and disallowed fishing equipment have been explicitly ruled under Perda No. 14 year 2015 [12] which is ruler modification (Perda No. 18 year 2010 [15]) about management of L3S. Periodically, the OKI Regency Government also undertakes to restock for fish recruitment every year. Through the auction scheme, five percent of the auction object payment will be allocated for restocking. According to fishermen and pengemin or auction winners, restocked fishes are not coming from local species, but an introduced species with good adaptability and fast-growing such as catfishes and nila or tilapia. This further causes local endemic fishes to compete in nature hardly and it could be a threat of extinction. The restocking of non-native fish seeds and the scarcity of local/indigenous fish species, particularly seed impacted on the difficulty of obtaining endemic fish with economic values.

The L3S management model in fact also faces the challenges related to approach to estimate the state of fish stock for auction. The estimation of maximum numbers of yield, whether through the assessment of Maximum Sustainable Yield and Maximum Economy Yield is hard to conduct because of the lack of data. Meanwhile, such estimation is critical because it could be the anchor of fixing the standardized price in the future. Also, based on the local regulation, it is stated that before initiating the auction process, the committee will determine the auction object value in the district level, usually based on the previous year’s determination. The unavailable precondition in estimating the fish stock and obstruction in collecting information about the caught fishes by pengemin causes difficulties in determining the auction object by the indication of size fish stock. Few other challenging issues are depicted on:

- OKI Regency has made regulation for conservation zone of fish, but in practice, the regulation still allowed for fish restocking with non-native (alien) species.
- Auction winner must donate five percent of revenue for fish stocking, but hard to be monitored and conducted.
- Auction winner supposed to report the catch data (volume by species and fishing gears), but fish catch data not available.
- The auction price determined by previous year auction and didn’t by fish stock condition.
- The auction mechanism did not consider Maximum Sustainable Yield and Maximum Economic Yield as Policy.
Difficulty accessing capital for local people third party funds as other options for accessing capital with deals and agreement between them.

4. Conclusion
The L3S model in OKI Regency has been employed for long, ruled explicitly under the local government regulations, involving the community participation. Such approach became a success factor in managing water area within the context of joint-ownership, which applies co-management principle emphasizing in equal opportunities for local people to participate in the auction process. The challenges, on the other hand, are laid on the approach to estimate fish stock and its state, the capacity of the local community to participate and controlling the auction winner to obey the rules. Thus, determining the total amount of caught fishes by pengemir or auction winner, evaluating the numbers of caught and the study of fish stocks and their state are needed to enhance the better allocation of fish stock and sustainability of fish resources. Determining the species of fish to be restocked is also necessary and makes a priority to the local/native or endogenous species to avoid the declining of original species of Lubuk Lampam. Therefore the advance study of local species and effort to domesticate will be needed.

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