Modeling of policy for mangrove utilization as a charcoal raw material in the local community in Batu Ampar, West Kalimantan

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Abstract. The utilization of mangrove as a raw material for charcoal in the local community is indicated to have caused the destruction of mangrove in Batu Ampar. This study aimed to formulate alternative scenarios of mangrove utilization as the raw material of charcoal by the community, and to design a policy model of mangrove utilization as a raw material of charcoal by the community. This research was conducted in Batu Ampar Sub District. Data collection was done through field observation, in-depth interview, document, and literature review. The formulation of scenarios as an alternative solution of mangrove utilization policy in Batu Ampar Sub District was done by descriptive analysis based on regulatory review, interview result and overall data in the field. The best scenario selected by professional judgment. The formulation of policy model was using a rational-comprehensive approach. From this research, the scenario for the use of mangroves for charcoal raw materials offered is encouraging the government to change the status and function of the protected forest areas into production forest areas. There are 3 alternatives of policies are offered, namely improving the work system of key players; increasing funding resources; and increasing capacity and capability of charcoal craftsmen.

1. Introduction
One form of utilization of mangrove forests in coastal areas of Indonesia is the utilization of mangrove wood for charcoal. The utilization of mangrove as raw material for charcoal in Indonesia can be found in Aceh Timur, Langkat, Batam, and Bengkalis in Sumatera [1]; Tuban and Banyuwangi in East Java [2], Takalar in South Sulawesi [3] and Kupu Raya in West Kalimantan. The sustainable management of mangrove utilization by the local community is not an easy matter because they usually have limited knowledge about mangrove ecosystem management [4] [5].
The policy model of the mangrove forests utilization as raw material for charcoal on the local community in Batu Ampar Sub District, Kubu Raya Regency as applied now is considered as an unsustainable model. The policy of mangrove forests utilization as raw material for charcoal in Batu Ampar Sub District can basically be in the form of utilization policies in the Community Plantation Forest (Hutan Tanaman Rakyat/HTR), Village Forest (Hutan Desa/HD), and/or Community Forestry (Hutan Kemasyarakatan/HKm) schemes [6]. But in fact, the utilization policy through these schemes has not been a solution to the problem of forest destruction due to the mangroves utilization for charcoal. In this context, there is a gap between policy objectives and its implementation in the field. The policy of mangroves utilization as raw material for charcoal in local community aims to improve the community access to the forest resources through the utilization schemes on timber forest products from mangrove forests in Batu Ampar Sub District. This is important, especially for increasing the income of coastal communities in the areas that have extensive mangrove forests and potentially for sustainable mangrove charcoal production.

The current policy model has not been able to resolve utilization problems of mangrove for charcoal in the local community in Batu Ampar Sub District. Therefore, modeling of policy is done through the formulation of the issues in the context of "problem-solving" to re-analyze the problem of the policy of mangroves utilization as raw material for charcoal in the local community. The goal is to reduce calibration errors. The model is a manifestation of the simplification of the reality of the problems faced by organizations in the form of causal or functional relationships, but not to simplify the substance of the problem [7]. The model is arranged in the form of a conceptual model for the mangrove forests utilization as raw material for charcoal in the local community.

This study aimed to formulate alternative scenarios of mangrove utilization as raw material for charcoal on the local community, and to design the policy model of mangrove utilization as a charcoal raw material in the community.

2. Methods
The research took place in Batu Ampar Sub-District, Kubu Raya District, West Kalimantan Province, Indonesia. The research was conducted in December 2015 – August 2016.

The scenario formulation is done by descriptive analysis based on the results of the in-depth interview and the overall data from the field. The alternative scenario was selected by using professional judgment.

Modeling of policy models used the Comprehensive-Rational Model Approach. [7] suggested the use of a rational-comprehensive model in the analysis of policy recommendations. The alternative chosen to solve the problem of the policy of mangrove forests utilization as raw material for charcoal on local community must fulfill the conditions referred to as the Comprehensive-Rational Theory. In making decisions, it through several procedures, namely: individual or collective decision makers must identify policy issues that are accepted as consensus by all relevant policy actors; individual or collective decision makers must define and rank consistently the goals and objectives for which achievement reflects problem-solving; Individual or collective decision makers must identify all policy choices that can contribute to the achievement of each goal; individual or collective decision makers must predict all consequences that will be produced by the selection of each alternative; Individual or collective decision makers must compare each choice in terms of the effect on achieving each goal; and Individual or collective decision makers must choose alternatives that maximize the achievement of goals.

Policy formulation used problem formulation analysis method. The formulation of the problem is carried out by examining the findings based on three aspects, namely the contents of the policy, the guardian of the rules, and the public response. These three aspects are aspects related to the policy system [7]. This method produces information about conditions that cause policy problems, carried out through 4 stages; namely: problem recognition, problem finding, defining the problem, and problem specifications.
The selection of the best policy alternatives was carried out with a PEST analysis approach, namely the assessment of alternative policies based on political feasibility, economy (efficiency), technical (effectiveness), and administration. Determination of scale and weight is based on professional judgment. Professionals consist of the central government representatives, Kubu Raya District governments, NGOs, and university. Professional judgment emphasizes and describes the selection process based on consideration and work results professionally [8].

3. Results and Discussions

3.1. The scenario of mangrove utilization as charcoal raw materials on the local community in Batu Ampar sub district

The area of mangrove forests in Batu Ampar Sub District currently reaches 61,001.60 ha. Most of the mangrove forests that are used as a raw material source for charcoal by the community are in the Protected Forest (Hutan Lindung/HL) area. The location of the area for taking raw materials as far as an average of 5–10 km from Batu Ampar Village. HL areas that are utilized include the HL area in the Forest Group (Kelompok Hutan/KH) Pulau Panjang I - IV; KH. Gunung Telok Air; KH. Sungai Lebak - Sungai Kerawang; KH. Padu Empat - Sungai Kerawang; and APL areas in Nipah Panjang Village and Teluk Nibung. Utilization of mangrove forests as raw material for charcoal on the local community in Batu Ampar without pocketing utilization permits is considered as a form of unsustainable utilization. The scenario of the use of mangrove forests as raw material for charcoal on the local community in Batu Ampar Sub District can be described into four alternative scenarios, consisting of 1 basic scenario and three alternative scenarios, namely:

- Status quo, the community continues to use mangroves from the HL area for charcoal raw materials (basic scenario);
- Encourage the government to change the status and function of the HL area to Production Forest (Hutan Produksi/HP);
- Encourage the community to utilize the HP that has not been burdened with utilization permits; and
- Encourage the companies that hold permits for utilization of timber forest products to establish cooperation or partnership with the community.

3.1.1. The scenario 1: Status quo

This scenario is the basic scenario, without any policy changes and various other interventions. The mangrove forests that are utilized are HL areas in the KH Pulau Panjang I, Pulau Panjang II, Pulau Panjang II, and Pulau Panjang IV; KH. Sungai Lebak - Sungai Kerawang; KH Padu Empat - Sungai Kerawang, and several other KHS around Batu Ampar Village.

The Excess of Scenario 1 is that the transportation cost of raw materials is lower because the area of mangrove forest that used as a source of charcoal raw material is close to the location of the charcoal kitchen.

The lack of the scenario 1 are:

- Utilization inform Community Plantation Forest (Hutan Tanaman Rakyat/HTR), Village Forest (Hutan Desa/HD), and Community Forestry (Hutan Kemasyarakatan/HKm) schemes cannot be applied in this scenario because the status of the mangrove forest area used is HL.
- Institutions remain illegal with the process of charcoal production, which is controlled by investors/collectors or cukong in the local term.
- Distribution of mangrove forests utilization in the HL area cannot be controlled because raw material extraction is carried out without planning in the entire mangrove forest area.
- The government does not receive input in the form of Forest Resource Provision (Provisi Sumber Daya Hutan/PSDH) on HTR; permit fees and PSDH on HKm; and permit holders
fees, PSDH, Reforestation Funds (Dana Reboisasi/DR) and or Replacement Value for Forest Stand (Penggantian Nilai Tegakan/PNT) on HD.

3.1.2. The scenario 2: Encourage the government to change the status and function of the area from HL to HP

This utilization scenario is directed at several regions that are currently in HL status. This scenario is based on the historical aspects of the region or the history of the utilization of mangroves for charcoal by the community in Batu Ampar. Before the Forest Land Use Agreement (Tata Guna Hutan Kesepakatan/TGHK) was conducted in 1982, the community had obtained a permit for Charcoal Kitchen Ownership and Mangrove Forest Management in the Sungai Limau area until Sukamaju and Pulau Panjang. The mangrove forest, which is allocated for this scenario is HL in KH. Pulau Panjang III and Pulau Panjang IV; HL at KH. Sungai Lebak - Sungai Kerawang; HL in KH Padu Empat - Sungai Kerawang (Figure 1, Table 1). The three locations of mangrove distribution in this scenario are mangrove forest areas that have been utilized by charcoal craftsmen in Batu Ampar Village. The estimated effective area uses the average effective area based on the AMDAL data of PT. Kandelia Alam (2007), which is about 62% of the total area of forest distribution.

![Figure 1. Location of mangrove forests which is allocated on Scenario 2](image)

**Table 1. Distribution of mangrove forests which is allocated on Scenario 2**

| No. | Distribution Location                  | Area (ha) | Effective Area (ha) | Sub District |
|-----|---------------------------------------|-----------|---------------------|--------------|
| 1   | HL in KH. Pulau Panjang III dan IV    | 4,926     | 3,054.12            | Batu Ampar   |
| 2   | HL in KH. Sungai Lebak – Sungai Kerawang | 5,442   | 3,374.04            | Batu Ampar   |
| 3   | HL in KH Padu Empat – Sungai Kerawang | 983       | 609.46              | Batu Ampar   |
| Total|                                       | 11,351    | 7,037.62            |              |

The excess of the scenario 2 are:
- The HTR, HD, or HKm scheme can be applied.
- The government or state obtains input in the form of PSDH on HTR, permit fees and PSDH on HKm, and fees for permit holders, PSDH, DR and or PNT on HD.
- Operational costs are lower because the raw material source area is close to the location of the charcoal kitchen.
The Lack of Scenario 2 is that the process to change the forest function is not easy and tends to cause high transaction costs.

3.1.3. The scenario 3: Encourage the community to utilize the HP that has not been burdened with utilization permits

The scenario of mangrove utilization as raw material for charcoal by the community can be through IUPHHK in the area of HP, Convertible Production Forest (Hutan Produksi Konversi/HPK) and/or Limited Production Forest (Hutan Produksi Terbatas/HPT) in accordance with the status of the existing function area, refers to the Decree of the Minister of Forestry 733/Menhut-II/2014. The mangrove forest allocated in this scenario is HPT in KH. S. Kubu - Munggulinang in Kubu Sub District and HPT in KH S. Bumbun in Batu Ampar Sub District (Figure 2, Table 2).

![Figure 2. Location of mangrove forests which is allocated on Scenario 3](image)

Table 2. Distribution of mangrove forests which is allocated in Scenario 3

| No | Distribution Location              | Area (ha) | Effective Area (ha) | Sub District   |
|----|-----------------------------------|-----------|---------------------|----------------|
| 1  | HPT in KH. Sungai Kubu – Munggulinang | 1,330     | 824.60              | Kubu           |
| 2  | HPT in KH. Sungai Bumbun          | 1,548     | 959.76              | Batu Ampar     |
|    | Total                             | 2,878     | 1,784.36            |                |

The excess of the scenario 3 are:
- The HTR and or HKm scheme can be applied.
- The government obtains input in the form of PSDH on HTR; and permit fees and PSDH from HKm.

The lack of the scenario 3 are:
- Operational costs are higher because the source of raw material is far away from the location of the charcoal kitchen.
- There is a potential conflict with the communities that use fishery products from the mangrove forest area.
- The number of kitchens needs to be reduced, adjusted to the existing raw materials. Mangrove forest with an area of 2,878 ha with an effective area of 1,784.36 ha can only meet the needs
of charcoal raw materials for a minimum of ± 163 kitchen units with a capacity of 3 tons per unit per cycle.

3.1.4. The scenario 4: Encourage the companies that hold permits for utilization of timber forest products to establish cooperation or partnership with the community

This utilization scenario encourages permit companies to establish cooperation or partnerships with the community in producing mangrove charcoal. In this scenario, the company acts as a provider of raw materials and markets for the community. The company provides mangrove wood for craftsmen to be processed into charcoal. Charcoal products from these craftsmen are then purchased by the company. In this context, the business of charcoal production carried out by the community is legal because the raw material comes from the company concession area.

The excess of Scenario 4 are:

- The company obtained incentives in the form of increasing the number of mangrove charcoal production units.
- The business of charcoal production on the community is legal with the raw materials provided by the company.

The lack of Scenario 4 are:

- Increase in operational costs, especially during the initial scenario.
- Vulnerable to company policies that can change at any time; this can be caused by several factors, including changes in government policies, changes in the price of charcoal, and the dynamics of company management.

Based on the description above, Scenario 2 is the alternative scenario chosen for the utilization of mangroves as raw material for charcoal by the community in Batu Ampar Sub District. HTR, HD, and HKm schemes can be applied in this scenario so that the government will get contributions through PSDH on HTR, permit fees and PSDH on HKm, and permit holder fees, PSDH, DR and or PNT on HD. This scenario is also considered more in line with the capacity of the charcoal craftsmen community in Batu Ampar.

Lack of scenario 4 is the process of changing regional functions that are not easy and tend to cause high transaction costs. This process requires a lot of money and a longer time. According to [9], changes in the designation and function of forest areas are not easy because they must comply with the criteria stipulated in government regulations [10] and ministerial regulations [11]; other than that, changes must also pay attention to the provisions and requirements stipulated in government regulations regarding the National Spatial Planning (Rencana Tata Ruang Wilayah Nasional/RTRWN) [12]. Changes in the designation and function of forest areas need to get recommendations from the provincial and district governments and must be based on an integrated assessment by an integrated team. Therefore, Scenario 4 can be chosen as an option to solve the problem of mangrove utilization for charcoal in the short-term. It means that alternative Scenario 4 can be executed while waiting for Scenario 2 to be realized.

3.2. Modeling of policy for mangrove utilization as charcoal raw material on local community

Formulation of policy issues based on the three aspects of the policy system, namely the contents of the policy; guardian of the rules; and community response regarding existing policy tools. These policy issues are described in problem situations, meta-problems, substantive problems, and formal problems. Based on various problems described in the meta-problem, it was concluded that the substantive problem consisted of 3, namely the lack of funding support for government officials, the behaviour and performance of stakeholders was still low, and the lack of capacity and capability of charcoal craftsmen.

Forecasting is defined as a procedure for making factual information about future social situations based on information on existing policy issues [7]. Based on the formal problems that have been found, then a policy alternative is determined to solve the problem along with the expected goals or targets, potential impacts, and future forecasts after the policy is implemented. Future predictions after
the implementation of the mangrove utilization for charcoal are implemented, including increasing institutional capacity, improving community welfare, and preserving mangrove forest areas. The success of community forest management in several regions not only benefits the managers but also has proven to contribute to forest sustainability [13]. [14] suggested that the relationship between forests and the integral role of communities are the key to sustainability and climate change adaptation.

The assessment of alternative policy criteria is carried out to determine the best rational policy alternatives to be implemented at this time. There are three alternatives policies, namely: improvement the work system of key players; increasing funding sources, and increasing the capacity and capability of charcoal craftsmen.

The key players who are related to the utilization of mangrove forest for charcoal in Batu Ampar Sub District consist of several stakeholders [15]. They are the Provincial Forestry Agencies; Agency for Monitoring and Production Forest Utilization (Balai Pemantauan Pemanfaatan Hutan Produksi/BPPHP); Watershed Management Office (Balai Pengelolaan Daerah Aliran Sungai/BP DAS); Forestry and Mining Plantation Service; Regional Office of the Forestry Planning Agency (Balai Pemantapan Kawasan Hutan/BPKH); Regional Development Planning Agency (Badan Perencanaan Pembangunan Daerah/BAPPEDA); NGOs; Forestry Police; University, and Regional Mangrove Working Group (Kelompok Kerja Mangrove Daerah/KKMD).

The policy of improving the work system of key players includes increasing the behavior of stakeholders in the implementation of duties and authority and improving the system of coordination and cooperation to support the performance of stakeholders in the utilization of mangrove forests as raw material for charcoal. According to [16], special attention to the aspect of coordination provides a good "answer" to the question about performance. The concept of coordination that is more tangible requires the design of the actual coordination instrument and the mechanism underlying all parties or stakeholders. Mapping the importance and influence of stakeholders in the use of mangrove forests as raw material for charcoal can be used for this purpose.

The capacity means the overall resources possessed by charcoal craftsmen, while the capability is related to the ability of craftsmen to improve and utilize all the resources they have. [17] suggested that integration between skills and knowledge is a competency that can be used as a prerequisite in succeeding of a program. Charcoal craftsmen in Batu Ampar Village have limitations in institutions, knowledge, and skills. Therefore, this policy includes the socialization of rules and opportunities for utilization, education, coaching, and training to improve the ability of the community to manage the organization and knowledge and skills in processing or producing quality charcoal. To be effective, charcoal craftsmen need intensive assistance from competent government and non-profit institutions. According to [18], assistance is a strategy that determines the success of various community empowerment programs. [19] suggested that non-profit institution play a very important role in the development and transformation of the environment, economy, society and politics in developing countries.

The policy to increase the funding sources aims to support the policy implementation of improving the performance of key players and increasing the capacity and capability of charcoal craftsmen. Increased funding sources include funding allocation programs sourced from government funds, both central and regional. Regulations regarding HTR, HD, and HKm regulate that the utilization of timber forest products by the community per group is carried out through cooperative institutions (Lembaga koperasi). Programs to improve the role of cooperatives and other financial institutions need to be carried out to support this policy. According to Edward III in [20], the budget relates to capital adequacy or investment in a program or policy to ensure the implementation of policies, because, without adequate budget support, a policy will not run effectively in achieving goals and objectives.

The selection of the best policy alternatives for the mangroves utilization as raw material for charcoal by the community is carried out through weighting based on political, economic, technical, and administrative feasibility criteria (Table 3).
Table 3. Assessment of policies alternatives

| No | Alternative of Policy                        | Political (Weight: 35) | Economic (Weight: 30) | Technical (Weight: 15) | Administrative (Weight: 20) | Total |
|----|---------------------------------------------|------------------------|-----------------------|------------------------|-----------------------------|-------|
|    |                                             | R S                    | R S                   | R S                    | R S                         |       |
| 1  | Improved work system of key players         | 3 105                  | 1 30                  | 4 60                   | 4 80                        | 275   |
| 2  | Increased funding sources                  | 1 35                   | 2 60                  | 4 60                   | 2 40                        | 195   |
| 3  | Increased capacity and capability of charcoal craftsmen | 3 105 | 1 30 | 3 45 | 4 80 | 260 |

R: Rating  
S: Score

Based on the results of the analysis, to solve the problem of illegal access on the utilization of mangroves as raw material for charcoal by the community in Batu Ampar Sub District, the alternative of policy as the priority policy direction at this time is to improve the working system of key players. This policy is related to the implementation of socialization of regulations, regional boundary arrangements, and law enforcement. In general, the three alternatives of policies are useful for increasing the welfare of coastal communities, especially in the areas with relatively similar with characteristics of region and communities in Batu Ampar. The area with mangrove forest which is extensive and potential for mangrove charcoal production but the level of education and knowledge of the people who are still low in managing coastal natural resources in a sustainable manner.

4. Conclusion
The alternative scenario for the utilization of mangrove forests as raw material for charcoal chosen is a scenario to encourage the government to change the status and function from the protected forest to production forest.

The policy model of the utilization of mangrove forests as raw material for charcoal in the community in Batu Ampar Sub District recommends the best policy alternative in the form of improving the working system of key players. Based on political, economic, technical, and administrative feasibility considerations, this alternative policy is considered the most rational to be implemented at this time.

The three alternative policies, namely improved work system of key players (stakeholders), increased capacity and capability of charcoal craftsmen, and increased funding sources, can be used as part of efforts to improve the welfare of coastal communities, especially in the areas that have extensive mangrove forests and potentially for sustainable mangrove charcoal production.

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